English Abstracts of Contributed Papers

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1A01 : Systemaric study of fission properties in proton-induced fission of uranium isotopes

Goto, S., Nishinaka, I.[1], Nagame, Y.[1], Ichikawa, S.[1], Tsukada, K.[1], Asai, M.[1], Haba, H.[1], Mitsuoka, S.[1], Nishio, K.[1], Sakama, M.[2], Zhao, Y. L.[2], Sueki, K.[2], Nakahara, H.[2], Tanikawa, M.[3], Takamiya, K.[4], Hamajima, Y.[5], Kaji, D., Kudo, H. (Fac. of Sci., Niigata Univ., Japan Atomic Energy Res. Inst.[1], Fac. of Sci., Tokyo Metroporitan Univ.[2], Fac. of Sci., Univ. of Tokyo[3], Res. Reactor Inst., Kyoto Univ.[4], Fac. of Sci., Kanazawa Univ.[5])

In order to study the correlation between the asymmetric mass distribution and the shell structure of fission fragments, the fragment mass and energy distributions in the proton-induced fission of uranium isotopes, ^{233,235,238}U, were accurately measured using the double time-of-flight method. It was found that the heavier asymmetric mass distribution shifted to heavier mass number with the fissioning nucleus mass number. The results would be originated from the increase of the mass number of the fragment with Z and that of the complementary light fragment with N.

1A02 : Fission characteristics of actinides

Nishinaka, I., Goto, S.[1], Nagame, Y., Ichikawa, S., Tsukada, K., Asai, M., Haba, H., Mitsuoka, S., Nishio, K., Sakama, M.[2], Zhao, Y.[2], Sueki, K.[2], Nakahara, H.[2], Tanikawa, M.[3], Takamiya, K.[4], Hamajima, Y.[5], Kaji, D.[6], Kudo, H.[6] (Advanced Sci. Res. Center, Japan Atomic Energy Res. Inst., Graduate School of Sci. and Technol., Niigata Univ.[1], Graduate School of Sci., Tokyo Metropolitan Univ.[2], Dep. of Chemistry, School of Sci., Univ. of Tokyo[3], Res. Reactor Inst., Kyoto Univ.[4], Graduate School of Sci., Kanazawa Univ.[5], Dep. of Chemistry, Fac. of Sci., Niigata Univ.[6])

Kinetic energy and mass distributions of fission fragments have been measured in the proton-induced fissions of ^{232}Th, ^{233,235,238}U, ^{237}Np, ^{239,242,244}Pu and ^{248}Cm. Based on the correlation between the kinetic energy and mass distributions, and its incident energy dependence, we are going to discuss dynamical deformation process from saddle point to scission point.

1A03 : Measurement of production cross sections for 12 GeV proton reactions with heavy targets (Pb, Bi) used as spallation neutron sources

Numajiri, M., Miura, T., Oki, Y., Suzuki, T., Kondo, K.[1] (Radiation Sci. Center, High Energy Accelerator Res. Organization, Applied Res. Labo., High Energy Accelerator Res. Organization[1])

Irradiation experiments were performed in order to investigate the production of residual nuclei by proton induced reactions at KEK proton synchrotron facility. Production cross sections in heavy mass targets (Pb, Bi) were measured by gamma-ray spectroscopy. These heavy targets will be used as spallation neutron sources. We report on the production of nuclides of near target and light mass, such as ^{7}Be, ^{22}Na, and ^{24}Na. The present data are compared with the results of previous measurements.

1A04 : Measurement of excitation function of ^{63}Cu(n,p)^{63}Ni reaction for E_n < 6.5MeV

Akamine, M., Takamiya, K., Shibata, S., Shibata, T.[1], Itoh, Y.[1], Imamura, M.[2], Uwamino, Y.[3], Nogawa, N.[4], Baba, M.[5], Iwasaki, S.[5], Matsuyama, S.[5] (Res. Reactor Inst., Kyoto Univ., Radiation Sci. Center, High Energy Accelerator Res. Organization[1], National Museum of Japanese History[2], RIKEN[3], RI Center, Univ. of Tokyo[4], Fac. of Engineering, Tohoku Univ.[5])

A purpose of this work is to measure an excitation function of ^{63}Cu(n,p)^{63}Ni reaction. The excitation function is indispensable to estimate radioactivities of ^{63}Ni produced in copper materials at reactor and accelerator facilities, and can also be applied to estimate a neutron flux of Hiroshima atomic bomb. We irradiated copper samples by neutrons with energies from 1.7 to 6.5 MeV. The ^{63}Ni produced in the copper sample was separated chemically and the excitation function was estimated from the results of β-ray countings by a low background liquid scintillation counter.

1A05 : Measurement of the half-life of ^{53}Mn.

Nagamine, T., Oura, Y., Yoneda, S.[1], Ebihara, M., Honda, M. (Dep. of Chemistry, Graduate School of Sci., Tokyo Metropolitan Univ., Dep. of Sci. and Engineering, National Sci. Museum.[1])

A value of 3.7±0.4Myr for the half-life of ^{53}Mn, which is mainly produced by cosmic rays in meteorites, was reported by Honda et al. in 1971. Recent development of mass spectrometry and low energy photon spectrometry have enabled us to measure isotopic ratio and X-ray counting precisely and accurately than before. So we aim to redetermine the half-life of ^{53}Mn by using modern mass spectrometer and low energy photon spectrometer.

1A06 : Detection of ultraviolet γ-rays from ^{229m}Th nucleus

Kasamatsu, Y., Takamiya, K.[1], Yamana, H.[1], Ohkubo, Y.[1], Toyoshima, A., Shibata, S.[1], Mitsugashira, T.[2], Kawase, Y.[1], Shinohara, A. (Graduate School of Sci., Osaka Univ., Res. Reactor Inst., Kyoto Univ.[1], Oarai-branch, Inst. for Materials Res., Tohoku Univ.[2])

It has been suggested that ^{229}Th nucleus has an anomalously low-lying isomer state (^{229m}Th) of 3.5±1.0eV. The excitation energy corresponds to 350nm ultraviolet photons. It has been estimated that about 1-2 percent of the total α decays of ^{233}U feed into ^{229m}Th. We separated ^{229}Th from ^{233}U with anion exchange method, and tried to detect ultraviolet γ-rays from ^{229m}Th and determine the half-life of ^{229m}Th with a low-noise photomultiplier.

1A07 : Search for Th-229m with UV comparable excitation energy.

Mitsugashira T., Hara M., Ohtsuki T.[1], Shinohara A.[2], Kasamatsu Y.[2], Takamiya K.[3], Yamana H.[3], Kikunaga H.[4], Nakanishi T.[5] (Oarai-branch, IMR, Tohoku Univ., Lab. Nucl. Sci., Graduate School of Sci., Tohoku Univ.[1], Graduate School of Sci., Osaka Univ.[2], Res. Reactor Inst., Kyoto Univ.[3], Graduate School of Sci., Kanazawa Univ.[4], Fac. of Sci., Kanazawa Univ. [5])

The excitation energy of Th-229m is known to be 3.5 eV. In order to produce Th-229m through (γ,n) reaction, a Th-230 target of high isotopic purity was irradiated by 22 MeV bremsstrahlung and the α-spectrum of the reaction products was examined. The result shows the formation of new α-emitter that has much shorter half-life than Th-229 and its α-energy coincides with the expected α-decay energy of Th-229m.

1A08 : α-Decay properties of neutron-deficient actinide isotopes.

Sakama, M., Tsukada, K.[1], Asai, M.[1], Ichikawa, S.[1], Oura, Y., Nishinaka, I.[1], Haba, H.[1], Nagame, Y.[1], Goto, S.[2], Kojima, Y.[3], Shibata, M.[4], Kawade, K.[4], Ebihara, M., Nakahara, H. (Dep. of Chemistry, Tokyo Metropolitan Univ., Res Group for Nuclear Chemistry of Heavy Elements, Advanced Sci. Res Center, Japan Atomic Energy Res Inst.[1], Dep. of Chemistry, Niigata Univ.[2], Dep. of Applied Physics, Hiroshima Univ.[3], Dep. of Applied Physics, Nagoya Univ.[4])

Experimental investigation of decay properties of neutron-deficient actinides are of importance. In particular, their α-decay property contributes to our understanding of the systematics of α-decay branching ratios and leads to precise values of nuclear masses in the region of neutron deficient actinides. Previously we identified the new isotopes,^{233}Am and ^{237}Cm, and observed the α-particle energy of those nuclides which include the ^{235}Am isotope. The half-lives and α-decay branching ratios of the neutron-deficient americium isotopes were determined in the present work. Using the obtained values, we investigated the systematics of α-decay branching ratio in the odd-mass neutron-deficient americium region. It is found that the α-decay of ^{233}Am and ^{235}Am is consistent with the systematics and the observed α-decay is a favored transition respectively.

1A09 : Structure and EC-decay properties of neutron-deficient light actinide nuclei.

Asai, M., Sakama, M.[1], Tsukada, K., Ichikawa, S., Haba, H., Nishinaka, I., Nagame, Y., Goto, S.2, Kojima, Y.[3], Oura, Y.[1], Nakahara, H.1, Shibata, M.[4], Kawade, K.[4] (Advanced Sci. Res. Center, JAERI, Dep. of Chemistry, Tokyo Metropolitan Univ.[1], Dep. of Chemistry, Niigata Univ.[2], Fac. of Engineering, Hiroshima Univ.[3], Dep. of Energy Engineering and Sci.,Nagoya Univ.[4])

EC/α-decay properties of neutron-deficient Am nuclei have been systematically studied using an on-line isotope separator. The results concerning the EC decay of ^{236}Am have revealed the relation between EC/α-decay probabilities and configurations of protons and neutrons in neutron-deficient light actinide region.

1A10 : Synthesis of ^{261}Rf and ^{262}Db

Tsukada, K., Haba, H., Asai, M., Nishinaka, I., Ichikawa, S., Nagame, Y., Sakuma, M.[1], Oura, Y.[1], Goto, S.[2], Kaneko, T.[2], Kudo, H.[2], Toyoshima, A.[3], Shoji, Y.[3], Yokoyama, A.[3], Shinohara, A.[3], Gaeggeler, H. W.[4], Tuerler, A.[4], Schaedel, M.[5] (Advanced Sci. Res. Center, Japan Atomic Energy Res. Inst., Fac. of Sci., Tokyo Metropolitan Univ.[1], Fac. of Sci., Niigata. Univ.[2], Fac. of Sci., Osaka. Univ.[3], Paul Scherrer Institute (PSI)[4], Gesellschaft fuer Schwerionenforschung (GSI)[5])

To investigate the chemical properties of the transactinide elements, the ^{261}Rf and ^{262}Db were produced in the ^{248}Cm(^{18}O, 5n) and ^{248}Cm(^{19}F, 5n) reactions using the JAERI tandem accelerator. The emitted alpha-particle were detected with the gas-jet transport system and the rotating catcher-wheel system, and the correlations of ^{261}Rf-^{257}No and ^{262}Db-^{258}Lr were observed. Then the production cross sections were about 6 nb for ^{261}Rf and about 1 nb for ^{262}Db, respectively. The cross section of ^{262}Db was 4 times larger than the reference value.

1A11 : Aqueous chemistry of Rf in JAERI.

Haba, H., Tsukada, K., Nishinaka, I., Asai, M., Sakama, M.[1], Goto, S.[2], Hirata, M., Ichikawa, S., Nagame, Y., Yokoyama, A.[3], Toyoshima, A.[3], Shoji, Y.[3], Shinohara, A.[3], Kaneko, T.[4], Kudo, H.[4], Oura, Y.[1], Schadel, M.[5] (Advanced Sci. Res. Center, Japan Atomic Energy Res. Inst., Graduate School of Sci., Tokyo Metropolitan Univ.[1], Graduate School of Sci., Niigata Univ.[2], Graduate School of Sci., Osaka Univ.[3], Graduate School of Sci., Niigata Univ.[4], , Gesellschaft fur Schwerionen forschung.[5])

In the last two years, we have developed a gas-jet coupled target system for production of the transactinide elements and an automated chemical processing system for fast and repetitive high performance liquid chromatography separation in order to investigate the chemical properties of the transactinide elements. We first intend to produce element 104, rutherfordium (^{261}Rf), and to perform its chemical experiment in aqueous systems. It is also important to compare the chemical properties of Rf with those of its lighter group 4 homologues Zr and Hf and its tetravalent actinide pseudo-homologue Th in order to verify influences of the relativistic effect. For this purpose, radiotracers of ^{88}Zr, ^{175}Hf, and ^{234}Th were prepared and various chemical properties such as absorption behavior and ion exchange behavior are now under study.

1A12 : Chemical separation for unknown isotope ^{252}Bk

Maruyama, T., Kaji, D., Kaneko, T., Kudo, H. (Fac. of Sci., Niigata Univ.)

It is difficult to produce of neutron rich nucleus of heavy actinides. Therefore, many nuclides have not been discovered so far even though they would have long halflife. It is expected that ^{252}Bk has about 10 minutes halflife and decays by β-delayed fission. The β-delayed fission is important to clarify fission process. ^{252}Bk could be produced by the reaction ^{248}Cm(^{18}O, X)^{252}Bk. In this reaction, many kinds of actinides would be produced at the same time. Chemical separation of ^{252}Bk from other actinides is essential in order to measure ^{252}Bk activity. For an a measurement, no residue is desirable after chemical separation. We chose anion exchange of HNO_3-CH_3OH system and search the optimum condition for the separation for ^{252}Bk.

1A13 : Gas chromatographic behavior of hafnium compounds

Kaneko, T., Ono, S., Kudo, H. (Fac. of Sci., Niigata Univ.)

Isothermal gas chromatography has been applied for the study of chemical properties of trans-actinides. Its analysis is, however, model dependent and is discussed without determination of species related to the sepataion. We studied gas phase reaction of Hf compounds in a gas chromatograph tube by the use of Gas Chromatograph - Mass Spectrometer (GC-MS) as a model experiment of Rf (Z=104). The reaction of Hafnium chloride and dipivaloylmethane and water were investigated. Volatile reaction products were chalacterized from observed mass spectra and chromatograms.

1A14 : Chemical separation of ^{248}Cm from old ^{252}Cf neutron sources (2).

Kaji, D., Kaneko, T., Kudo, H., Hara, M.[1], Suzuki, Y.[1], Watanabe, M.[1], Mitsugashira, T.[1] (Fac. of Sci., Niigata Univ., Inst. for Materials Res., Tohoku Univ.[1])

The usage of ^{248}Cm as a target for the production of heavy and trans-actinide elements is considered. As ^{248}Cm has not been provided in Japan, ^{248}Cm must be purchased from abroad. However, if ^{248}Cm can be separated from old ^{252}Cf neutron sources, it is possible to make a ^{248}Cm target in Japan. And so, ^{248}Cm was separated from old tight sealed ^{252}Cf neutron sources. In this presentation, the detail of a chemical separation method and possibility for making a ^{248}Cm target will be reported.

1A15 : Direct observation of Cm(III)-fulvate complex sorbed on montmorillonite.

Takahashi, Y., Kimura, T.[1], Kato, Y.[1], Minai, Y.[2] (Graduate School. of Sci., Hiroshima Univ., Japan Atomic Energy Res. Inst.[1], Center for Arts and Sci., Musashi Univ.; Nezu Inst. for Chemistry[2])

Among the factors controlling the behavior of trivalent actinide (An) in water-rock systems, complexation with humic substances and sorption on clay minerals are important. Because of the strong affinity of humic substances and clay minerals, it is probable that An(III) is sorbed on clay minerals as the complexes with humic substances. In this paper, Cm(III) species at a montmorillonite-water interface in the presence of fulvic acid were directly observed by laser-induced fluorescence spectroscopy. Based on the emission spectra and emission decay constants of the fluorescence from Cm(III), it was revealed that Cm(III) can be sorbed as fulvate complex on the montmorillonite surface. These facts explain the present result of batch experiments that the distribution of Cm(III) between aqueous phase and montmorillonite's surface is similar to that of fulvic acid. Based on these results, it is implied that the solid-water distributions of humic substances are important to estimate the behavior of An(III) in a natural aquifer.

1A16 : Speciation study of Eu(III) and Cm(III) in anion exchange separation system using LiCl-methanol solvent mixtures

Arisaka, M., Kimura, T.[1], Kato, Y.[1], Takeishi, H.[1], Suganuma, H.[2], Yoshida, Z.[1] (Shizuoka Univ., Japan Atomic Energy Res. Inst.[1], Fac. of Sci., Shizuoka Univ.[2])

The separation mechanism of M(III) [M = Eu, Cm] in anion exchange system using lithium chloride-methanol solvent mixtures was discussed on the basis of the speciation of M(III). The inner-sphere hydration number (N_{H2O}) of M(III) was used for the speciation in this work. The N_{H2O} of M(III) in solution and resin phases were determined by measurements of the luminescence lifetimes. It was revealed from the results that (1) the complexation of Cm(III) with chloride ion is much stronger than that of Eu(III), (2) higher order chloro complexes of M(III) are formed in resin phase and (3) the complexation with chloride ion is promoted by the methanol addition. Consequently, the increases of K_d with increasing lithium chloride and methanol concentrations results from the effects of (2) and (3). Moreover, the enlargement of separation factor [K_d(Cm)/K_d(Eu)] with increasing methanol concentration is due to the effect of (1).

1A17 : Extraction of lanthanides(III) with multidentate diamide compounds

Narita, H., Yaita, T., Tachimori, S., Nakano, Y.[1] (Japan Atomic Energy Research Institute, Ibaraki Univ.[1])

The extraction behavior of Ln(III) and Am(III) with N,N'-dimethyl-N,N'-diphenyl-malonamide (MA), -diglycolamide (DGA) and -3,6-dioxaoctanedioic diamide (DOODA) and the structural properties of their complexes were investigated. The distribution ratios of Ln(III) and Am(III) increase in the order MA > DOODA > DGA. The structural parameters were obtained by EXAFS. The carbonyl oxygen atoms in all the diamide complexes directly coordinate to Ln(III). In the DGA and DOODA complexes, the ether oxygen atoms also directly bind to Ln(III).

1A18 : Study of actinide ions transfer at aqueous / organic interface by radiovoltammetry.

Kitatsuji, Y., Kimura, T., Yoshida, Z., Kudo, H.1, Kihara, S.[2] (Japan Atomic Energy Res. Inst., Graduate School of Sci., Tohoku Univ.[1], Dep. of Chemistry, Kyoto Inst. of Technol.[2])

Radiovoltammetry for the ion transfer at the interface between two immiscible electrolyte solutions (RITIES) was developed. This new method is based on the measurement of the relationship between the interfacial potential of two phases and the amount of the ion transferred after controlled-potential electrolysis in stead of potential-current relationship measurement. Radioactivity of both phases was measured as the concentration of radioactive ions in the solution. RITIES has advantages, comparing with the conventional potential-current relationship measurement: (1) even at the potential where a large residual current flows, the potential-radioactivity curve can be determined; (2) ion transfer of such low concentration as tracer level can be measured. Actinide ion transfer was investigated by RITIES, and ion transfer free energy for actinide ions was estimated from these results.

1B01 : Nuclear and radiochemistry education through social education II.

Aratani, M. (Inst. of Environmental Sci.)

The critical accident of the nuclear-fuel processing plant in Tokai has rastically changed the implication of nuclear and radiochemistry education through social education in Rokkasho, the special nuclear site in Japan. It was once a taboo to tell neutron of extrareactor or even at the background level, because it was regarded as "waking of children in sleep". More indirect and round about approaches through science history and science literacy, however, have been replaced by a positive learning of nuclear and radiochemistry as knowledge for survival here. Now people are willing to come together to try radioactive measurements with us at their Community Hall. A great impact has been given to the public by the death of two sacrifices.

1B02 : The techniques and laboratory equipments for safe handling of radioisotopes.

Asano, T. (Res. Ins. for Advanced Sci. and Technol., Osaka Prefecture Univ.)

For the progress of the utilization of radioisotopes in the field of science and industry, it is necessary to promote positively the upbringing of successors who can handle radioisotopes. The development of the techniques of safe handling of radioisotopes is much indebted to the development of radiochemistry. we must carry out the sort of the basic radioisotope handling techniques, having been obtained through the experience in the investigations of radiochemistry, and serve an aid for the practical use of these knowledge to the education/training of new radiation workers. The present report is concerned with the introduction of the comprehensive techniques and laboratory equipments for safe handling of radioisotopes, which were used in our investigations of radiochemistry.

1B03 : Analytical method for the determination of radionuclides in low level radioactive waste
- Determination of Technetium-99 -

Kaneko, K., Morimoto, T., Tsubuku, T., Banba, S., Nakashima, M.[1], Hirayama, K.[1], Higuchi, H. (Japan Chemical Analysis Center, Japan Atomic Energy Res. Inst.[1])

A method has been developed for the separation and purification of ^{99}Tc in low level radioactive waste. Tc(IV), reduced by potassium pyrosulfite, was coprecipitated with iron(II) hydroxide. Precipitate was dissolved into hydrochrolic acid. Tc(IV) oxidized to Tc(VII) by hydrogen peroxide. Tc was purified by extraction chromatographic resin. ^{99}Tc was determined by gas-flow low background beta counter. The decontamination factor of ^{60}Co and ^{137}Cs was more than 10^5. The minimum detectable level of ^{99}Tc was 0.2 mBq/g, which was estimated from 10g sample, 1200m counting time, 60 % recovery and counting background of 0.3 cpm conditions. ^{99}Tc concentration in low level radioactive waste such as cement and asphalt solidified waste, ash and rubber gloves were observed ranging from 0.014 to 270 Bq/g as a results of this method.

1B04 : Formation mechanism of technetium colloids by irradiation of bremsstrahlung

Narushima, H., Sekine, T., Kino, Y., Kudoh, H. (Graduate School of Sci.Tohoku Univ.)

We have found the radiolytic formation of technetium dioxide hydrate colloids in pertechnetate solutions by the irradiation of bremsstrahlung. A TEM analysis showed the size distribution of the colloids ranging from 50 to 130 nm depending on the dose of irradiation. The amount of the colloids increased with an increase of the dose of irradiation and the formation rate was enhanced at a higher dose rate. We propose a formation mechanism that involve the reduction of pertechnetate by radicals formed through radiolysis of water and disproponation reactions of reduced technetium ions, followed by coagulation reactions.

1B05 : Measurements of electron spin resonance spectra and radiation-induced luminescence from some feldspars

Hashimoto, T., Nishiyama, E., Hase, H.[1] (Fac. of Sci., Niigata Univ., Res. Reactor Inst., Kyoto Univ.[1])

Radiation defects in some feldspars, including microcline and albite, were investigated from aspects of correlation between thermoluminescence phenomena and ESR-signals. Al-O center and H-radical were found in any feldspars when the samples were irradiated and measured at 77K. After warming to room temperature, Al-O center was converted into Al-O-Al center. The complete disappearance of H radical after warming was verified to be operated to decrease of Al-O-Al center, which was identified to a main center of blue TL possessing 180°C peak. The thermal annealing treatment of microcline beyond 700°C brought on appearance of two new hydrogen signals, which are observable in room temperature.

1B06 : Infrared characterization of OH impurity species and radiation-induced luminescence for natural quartz

Yanagawa, Y., Tsuboi, T.[1], Hashimoto, T.[1] (Graduate School of Sci. and Technol., Niigata Univ., Fac. of Sci., Niigata Univ.[1])

The mechanism of the blue thermoluminescence for natural quartz has been discussed on the basis of the OH impurity, the color center distribution, and the thermoluminescence color image. Microscopic infrared spectroscopy clarified the behaviors of OH species in natural quartz due to gamma-ray irradiation. The mapping for the Al-OH absorption band revealed that the darker color center corresponded to the weaker absorption. The darker color resulted in blue therrmoluminescence with higher intensity, according to the thermoluminescence color image. The Al-OH concentration after irradiation decreases while the intensity of blue thermoluminescence and the darkness of color center were increased. These results show that the impurities related to OH have an effect on the quenching for radiation-induced emission and that the hydrogen radical derived by the irradiation acts as a killer of radiation-induced Al center.

1B07 : Gamma-ray dosimetry using radiation-induced luminescence from ceramic pieces at the criticality accident sites of JCO.

Takano, M., Nakagawa T.[1], Hashimoto, T.[1] (Graduate School of Sci. and Technol., Niigata Univ., Fac. of Sci., Niigata Univ.[1])

Thermoluminescence (TL) from some pieces of ceramic and glass crucibles was investigated for the radiation dosimetry in the JCO-accident sites using a highly sensitive TL-measuring apparatus. In thermoluminescence color images (TLCIs), all ceramic disks gave a homogeneous red-TL (RTL) distribution, whereas glass disks showed yellow and blue coloration in low and high temperature regions, respectively. Among these specimens, the RTL glowcurves from as-received grains of alumina crucibles were estimated to be derived from the recently artificial radiation owing to accumulated dose beyond presumable natural dose. Good dose-response curves of the alumina disks were assured by applying known doses, especially in the low dose regions below 1 Gy. Finally, the radiation dose was evaluated to be about 30 -60 mGy at about 50 m distance from the accident site.

1B08 : Positive muons in asodium-ammonia solutions

Kubo, M. K., Nishiyama, K.[1] (Dep. of Chemistry, School of Sci., Univ. of Tokyo, High Energy Accelerator Res. Organization[1])

Chemical behavior of positive muons in condensed phase ammonia and sodium-ammonia solutions was investigated. Neat ammonia showed a clear muonium signal at 200 K, while at 220 K muonium spin relaxation rate was faster and no clear muonium signal was observed. This phenomenon might be ascribable that the solvated electrons formed by the incident muons react with muonium, and the reaction rate has large temperature dependence.

1B09 : Velocity degradation processes of high-energy particles in mixed solvent system

Sakai, Y., Kubo, M. K.[1], Yonezawa, C.[2], Matsue, H.[2] (Dept. of Chemistry, Daido Inst. of Technol., School of Sci., Univ. of Tokyo[1], Japan Atomic Energy Res. Inst.[2])

Velocity degradation processes were investigated for ^{7*}Li with an initial kinetic energy of 840 keV produced via the ^{10}B(n, alpha)^{7*}Li reaction. With a lifetime of 0.1ps, ^{7*}Li decays and emits the prompt gamma ray of 478 keV. The prompt gamma rays are emitted from the moving ^{7*}Li ions, which leads to the Doppler broadened line shape. The degree of the Doppler broadening is expected to reflect the velocity degradation. In the present work, the 478keV-prompt gamma rays were measured and analyzed in boron compounds dissolved in mixed solvent such as methanol and benzene in order to clarify the influences of intermolecular interaction of solvent on the stopping power of charged particle.

1B10 : Studies on hot atom chemical behavior of energetic ions in solids (III) —Chemical behavior of energetic deuterium ions in graphite—

Sugiyama, T., Morimoto, Y., Kodama, H., Okuno, K.. (Radiochemistry Res. Lab., Fac. of Sci., Shizuoka Univ.)

From fusion safety point of view, studies on hot atom chemical behavior of energetic tritium implanted into plasma facing materials have been carried out. This is also an important subject for high energy chemistry. In the present study we investigated the chemical behavior of energetic deuterium implanted into graphite by Thermal Desorption Spectroscopy (TDS). TDS measurements were made on D_2 and CD_4 from surface layer of pyrolytic graphite cleavage surfaces after 1 keV D_2^+ irradiation to 1.0×10^{22} D / m^2 at irradiation temperatures from 173 K to 673 K. From the TDS results, we discussed the dependence of irradiation temperature on release behavior of D_2 and CD_4.

1B11 : Application of coincidence doppler spectroscopy to polymer

Suzuki, T., Kondo, K., Hamada, E.[1], Chen, Z. Q.[2], Ito, Y.[3] (Radiation Sci. Center, High Energy Accelerator Res. Organization, Dep. of Radiological Sci., Ibaraki Prefectural Univ. of Health Sci.[1], Inst. of Applied Physics, Univ. of Tsukuba[2], RCNST, Univ. of Tokyo[3])

A coincidence Doppler spectroscopy was applied to polymer, using two Ge solid state detectors (SSD). The ratio of peak to back ground of the Doppler broadening spectrum obtained by one SSD detector was about 10^{-3}. This ratio was improved by taking coincidence of two Ge detectors, resulting in the order of 10^{-5}. By this method positron annihilation with inner orbital electrons with large momentum can be detected. This can be applied to microanalysis of metallic elements with a high momentum inner orbital electrons.

1B12 : Free volume in polycarbonate studied by positron annihilation: temperature and irradiation effect on positronium formation

Chen, Z. Q., Suzuki, T.[1], Kondo, K.[1], Hamada, E.[2], Uedono, A., Tanigawa, S., Ito, Y.[3] (Inst. of Applied Phys., Univ. of Tsukuba, Radiation Sci. Center, High Energy Accelerator Res.[1], Dep. of Radiological Sci., Ibaraki Prefectural Univ. of Health Sci.[2], RCNST, Univ. of Tokyo[3])

In this paper, we studied the free volume properties in polycarbonate by positron annihilation lifetime spectroscopy (PALS) as a function of temperature and elasped time. Free radicals and trapped electrons were introduced when the sample was exposed to positron source irradiation at room temperature and low temperature, respectively. O-Ps lifetime was not affected by irradiation, but free radicals act as a scavenger of electrons and prohibit the formation of positronium, while the trapped electrons enhance the Ps formation. By measuring the lifetime spectra in the temperature range from 20 to 220°C, and from 30 to 375K, we observed that the glass transition temperature was about 140 °C . The methyl group rotation was known to start at about 100K, and caused the electrons to get detrapped from the free volumes. Another transition, the brittle-ductile transition, was also observed, which occurred at about 230K.

1B13 : Time-differential perturbed angular correlation of ^{117}Cd—>^{117}In and ^{111m}Cd—>^{111}Cd in 8-mol% In-doped $LiTaO_3$

Ohkubo, Y., Saito, T.[1], Yokoyama, A.[2], Uehara, S., Kawase, Y. (Res. Reactor Inst., Kyoto Univ., RI Res. Center, Osaka Univ.[1], Graduate School of Sci., Osaka Univ.[2])

The nuclear-electric-quadrupole interactions at ^{117}In and ^{111}Cd arising from ^{117}Cd and ^{111m}Cd, respectively, each chemically introduced in 8-mol% In-doped ferroelectric $LiTaO_3$ (T_C = 818 K) polycrystals, were studied by measuring the time-differential perturbed angular correlation of gamma rays over a temperature range from 4.2 to 1073 K. Well-defined, essentially single, static electric quadrupole frequencies ω_Q were observed for ^{117}In and ^{111}Cd in the oxide. There is a significant difference between the temperature dependence of ω_Q of ^{117}In and that of ^{111}Cd: the former temperature dependence reflects the phase transition at 818 K, whereas the latter does not so. This observation indicates that the Cd ions at the Li sites are in peculiar physicochemical states.

1B14 : Application of TDPAC to metallofullerene studies (III).

Sato, W., Sueki, K.[1], Achiba, Y.[1], Nakahara, H.[1], Ohkubo, Y.[2], Asai, K.[3] (Applied Nuclear Physics Lab., RIKEN., Graduate School of Sci., Tokyo Metropolitan Univ.[1], Res. Reactor Inst., Kyoto Univ.[2], Dep. of Applied Physics and Chemistry, Univ. of Electro-Communications[3])

The time-differential perturbed angular correlation (TDPAC) method has been applied to the study of the electronic state of endohedral Ce fullerenes: $Ce@C_{82}$, $Ce@C_{80}$, and $CeLa@C_{80}$. For evaluating the oxidation state of the probe <ue>140</ue>Ce, comparative studies have been performed with the same probes incorporated in other substances such as graphite, diamonds, and some inorganic compounds (LaF_3, $La_2(C_2O_4)_3$, $PbTiO_3$, La_2O_3). It has been found that the estimated values for the electric field gradients (EFG) at the site of the probe nuclei accommodated inside the carbon cages and between the graphite layers are by far greater than those observed for ^{140}Ce in the diamonds and inorganic compounds. Because there is little contribution of the asymmetric charge distribution in the lattice to the magnitude of the EFGs, we have inferred that the large magnitude of the EFGs for the Ce fullerenes and graphite can be attributed to a 4f electron; i.e. the Ce atoms encaged in fullerene cages are in the state of Ce^{3+}.

1B15 : Moessbauer isomer shifts of ^{133}Cs in transition metals

Shimomura, H., Yoshikawa, K., Muramatsu, H., Watanabe, S.[1], Osa, A.[1], Koizumi, M.[1], Sekine, T.[1] (Dep. of Chemistry, Fac. of Education, Shinshu Univ., Dep. of Chemistry and Fuel Res., Japan Atomic Energy Res. Inst.[1])

Moessbauer effect measurements for the 81 keV transition in ^{133}Cs have been performed with sources of ^{133}Xe implanted into transition metals. The sources were prepared by means of an electromagnetic isotope separator. The aim of the present work is to find a correlation between measured isomer shift of ^{133}Cs and physical and chemical properties of the host metals. The fine correlation was found between measured isomer shift and bulk modulus of the host metal, and it was interpreted as the compression effect due to host matrices.

1B16 : In-beam Mössbauer studies on chemical states of ^{57}Fe Atoms decaying from ^{57}Mn

Kobayashi, Y., Kubo M. K.[1], Yamada, Y.[2], Yoshida, A., Ogawa, H.[3], Ueno, H., Asahi, K.[3], Ambe, F. (RIKEN, Dep. of Chemistry, Univ. of Tokyo[1], Dep. of Chemistry, Sci. Univ. of Tokyo[2], Tokyo Inst. of Technol.[3])

^{57}Mn ions are produced and subsequently implanted into a sample of $KMnO_4$ as a secondary RI beam by projectile fragment reaction of ^{59}Co beam with a Be target. ^{57}Fe Mössbauer spectra were measured using in-beam technique at 25 and 155 K. The spectra can be fitted with two single lines, which are assigned to Fe(II) and Fe(V or IV) species.

1B17 : ^{155}Gd Mössbauer spectra of $GdM(CN)_6 \cdot nH_2O$ and $KGdM(CN)_6 \cdot nH_2O$

Kitazawa, T., Abe, J., Wang, J., Takahashi, M., Takada, M. (Fac. of Sci., Toho Univ.)

^{155}Gd Mössbauer spectra for the coordination polymer $GdFe(CN)_6.4H_2O$ (I) and $KGdFe(CN)_6.3H_2O$ (II), in which $[Fe(CN)_6]^{n-}$ units are bonded to Gd^{3+} through CN-, are measured at 12 K. The isomer shift (δ; relative to the $^{155}Eu/SmPd_3$ Mössbauer source) and quadrupole coupling constant for I are 0.61 and 4.24 mm s^{-1}, while those for II are 0.54 and 4.49 mm s^{-1}. The Moessbauer parameters suggest that both complex have the same coordination geometry of GdN_6O_2. The small difference in the value of δ suggest that the electronic state of Gd^{3+} would be slightly affected by the oxidation state of iron ion. The electronic state of Gd^{3+} might be also affected by the chemical species included in the cavity of the crystal structure, i. e., water (I) or water and K^+ (II).

1B18 : Mössbauer spectrum of iron fine particles: Computer simulation.

Kobayashi, T., Fukumura, K. (Siga Univ. of Medical Sci.)

The growing up of iron fine-particles was simulated with a computer and the expected Mössbauer spectra at various temperature were calculated from the arrangement of atoms which were compared with the observed spectra of fine particles of ^{57}Fe formed in a sapphire crystal by the implantation technique. Considering the superparamagnetic relaxation and the fluctuation by collective magnetic excitation, the Mössbauer spectrum of iron fine particles was estimated. The surface effect of fine particles was reflected by estimating the magnetic hyperfine field proportional to the nearest and next nearest neighbors. The simulated temperature-dependent spectra were reproduced well the observed ones.

1C01 : Photon activation analysis of halogens in meteorites

Nakamoto, T., Latif, A. Sk., Oura, Y., Ebihara, M. (Fac. of Sci., Tokyo metropolitan Univ.)

In order to determine halogen contents with a high sensitivity, we have developed a radiochemical photon activation analysis (RPAA) method. We have established a chemical separation procedure for halogens in rock and meteorite samples. We first fused irradiated samples using NaOH with carrier of halogens and then separated halogens from the matrix. Iodine and fluorine were precipitated as PdI_2 and CaF_2, respectively, while chlorine and bromine were precipitated as Ag-halides. We found an apparent loss of I from reagent standard samples and powdered sedimentary rock samples during irradiation. Taking into account this problem, we try to establish a RPAA procedure to measure four halogens (F, Cl, Br, I) from a single meteorite sample.

1C02 : Application of array of germanium detectors for analytical chemistry.

Hatsukawa, Y., Oshima, M., Hayakawa, T., Toh, Y., Shinohara, N., Kushida, K.[1], Ueno, T.[1] (Dep. of Material Sci., Japan Atomic Energy Res. Inst., Dep. of Environmental Sci., Japan Atomic Energy Res. Inst[1])

The multidimensional gamma ray spectroscopy method was applied for determination of ^{129}I. 20ng of ^{129}I sample was irradiated at a research reactor of JAERI. Gamma-gamma coincidence of multiple gamma-rays from ^{130}I which produced via the ^{129}I (n,gamma) ^{130}I reaction were measured with a multidimensional spectrometer, GEMEINI. Form analysis of this experiment, detection limits of ^{129}I was estimated as $^{129}I/^{127}I = 2 \times 10^{-11}$.

1C03 : Accuracy of k_0-facotors for neutron induced prompt gamma-ray analysis

Matsue, H., Yonezawa, C. (Res. Group for Analytical Chemistry, Dep. of Environmental Sci., Japan Atomic Energy Res. Inst.)

The k_0 standardization method has been studied and applied to many kinds of standard reference materials at JAERI for the accurate determination of multielements by neutron-induced prompt gamma-ray analysis. Up to now, the k_0-factors for 27 elements using Cl as a comparator have been measured by the cold and thermal neutron guided beams of JRR-3M. In this study, we evaluated the accuracy of the k_0 factors by the following manners. 1) The obtained k_0-factors were compared with those obtained with thermal neutron guided beam at the Institute of Isotope and Surface Chemistry (IKI) in Hungary. 2) The k_0-factors were compared with those calculated by using the evaluated thermal neutron capture gamma-ray data ($Z < 21$) from the LBNL (Lawrence Berkeley National Laboratory, USA)-IKI and the Lone's table.

1C04 : Improvement of JRR-3M prompt gamma-ray analysis system -Installation of new BGO detectors and charged particle measurement system-

Yonezawa, C., Matsue, H., Ota, K., Sasajima, F. (Japan Atomic Energy Research Institute)

Since 1991, the JRR-3M prompt gamma-ray analysis system has been utilized by the scientists both from foreign countries and Japan. Recently new BGO detectors and charged particle spectrometer were installed to the PGA system to improve ability of the system. Background count rate of Bi-207 decreased by factor ten and only double escape peaks detected in the pair mode spectrum by the improvement. Furthermore, neutron depth profiling of boron and lithium has become possible by the improvement.

1C05 : Studies on provenance problems of ancient ceramics, Sueki — Looking for new finger print elements—

Mitsuji, T., Nakano, Y.[1], Yamakawa, S., Miyazaki, T. (Dep. of Chemistry, Nara Univ. of Education, Res. Reactor Inst., Kyoto Univ.[1])

A new method was developed for sourcing the sueki excavated from tomb sites in the Kohun period. The useful finger prints were K, Ca, Rb, and Sr. Sc and La were determined by activation analysis, as new finger print elements. How useful are the new finger print elements, Sc and La ? This is a new problem in this work. The obtained data will be shown in this oral presentation.

1C06 : Neutron activation of various materials at the height of commercial flight.

Komura, K. (Low Level Radioactivity Labo., Kanazawa Univ.)

Neutron activation at the height of domestic and international flight has been investigated using various target materials such as metallic powder and chemical reagents. The samples exposed to cosmic ray neutrons were transported to Ogoya underground laboratory as soon as possible after landing and measured by using extremely low background Ge detectors. By the domestic flight, very short lived ^{116m}In and ^{56}Mn were successfully detected though peak area were extremely low. On the other hand by international flights, more 10 short-lived nuclides could be added to the list of neutron-induced natural radionuclides : ^{24}Na、^{82}Br, ^{140}La, ^{152m}Eu, ^{175}Yb, ^{187}W, ^{186}Re, ^{188}Re, ^{192}Ir and ^{194}Ir. These nuclides are considered to be very useful to get information of cosmic-ray neutrons and to evaluate neutron exposure during flight.

1C07 : Measurements of artificial radionuclides in seaweed and seawater --- Application of low background γ-ray spectrometry to marine environment ---

Inoue, M., Kofuji, H., Yamamoto, M., Sasagawa, H., Sasaki, K., Komura, K. (Fac. of Sci., Kanazawa Univ.)

For monitoring of artificial radionuclides (radioactive corrosion products and ^{137}Cs), seaweed and seawater samples were collected at four locations near the Shika atomic power plant, Ishikawa Pref. Potassium is main constituent element in seaweed and existence of ^{40}K interferes with the detection of low level radioactivities of artificial nuclides. So in this work, we applied water leaching treatment to ashed seaweed for removal of ^{40}K, and then extremely low background γ-ray spectrometry were carried out in these samples. As results of these processes, clear signals of natural (^{238}U and ^{232}Th series) and artificial (^{137}Cs) nuclides were obtained, but radioactive corrosion products were not detected so far.

1C08 : Study on the reliability of analytical methods for the determination of uranium and thorium in semiconductor memory materials

Mitsugashira T., Hara M., Kim P.[1], Nakashima K [2]., Nakayama K.[2], Kuroiwa Y.[2] (Oarai-branch,Inst. for Materials Res., Tohoku Univ., Vacuum Metallurgical Co.,Ltd.[1], ULVAC Metarials Technology Co.,Ltd.[2])

Elimination and the ultra trace analysis of uranium and thorium in memory device materials are important research targets in modern semiconductor industry. Commonly used analytical methods such as RNAA, ICP-MS, GD-MS is valid for long life alpha-emitters and the probability of soft errors is evaluated by assuming the radioequilibrium in natural alpha-decay series without the direct determination of daughter alpha-emitters. Authors compared the analytical results of high-purity aluminum obtained by RNAA, ICP-MS, GD-MS, and Sm-method that is recently developed for the direct determination of decay series alpha-emitters and confirmed that all analytical methods are reliable for the determination of U-238 and Th-232. But radio-disequilibrium enrichment of daughter nuclides is detected by Sm-method. The results imply that the soft-error probability must be evaluated by the analysis of all decay series alpha-emitters.

1C09 : Atmospheric concentration of ^{210}Pb at Beijing and Chengdu, the People's Republic of China.

Sato, S., Doi, T.[1], Sato, J. (School of Sci. and Technol., Meiji Univ., National Inst. for Environmental Studies[1])

Atmospheric concentrations of ^{210}Pb were observed in the eastern area of the People's Republic of China with aerosol samples. Observations were carried out intermittently during the period from April, 1989 to December, 1992 at Beijing and Chengdu. The atmospheric concentrations of ^{210}Pb ranged from 0.9 to 4.6 mBq/m^3 at Beijing and from 1.4 to 7.8 mBq/m^3 at Chengdu, respectively, which were in the similar level to those observed previously in the inland area of the Chinese Continent. Seasonal variations of the ^{210}Pb concentration show the "one-peak" variation pattern : the maximum levels were recorded in winter season. Small additional rises in the atmospheric ^{210}Pb concentrations observed in the period from spring to autumn seasons may be due to complicated meteorology with high pressure systems at Beijing and due to the topographical situation at Chengdu.

1C10 : Activity ratios of uranium isotopes in volcanic rocks from Izu-Mariana arc volcanoes.

Sato, J., Endo, M. (School of Sci. and Technol., Meiji Univ.)

The ^{234}U/^{238}U activity ratios of 45 volcanic products from 6 volcanoes of Izu-Mariana island-arc and also those from Hawaian island and Iceland ranged from 0.96 to 1.04 forming a Gaussian distribution with the average value of 0.997 and the standard deviation of 0.014, indicating that the ^{238}U - ^{234}U is almost in radioactive equilibrium in the erupting magmas from island-arc volcanoes.

1C11 : Radioactive disequilibrium states of the U-series nuclides in soil samples from the JCO criticality accident site

Kawabata, Y., Yamamoto, M., Murata, Y., Komura, K. (Low Level Radioactivity Labo., Kanazawa Univ.)

Soil samples collected from JCO campus following the criticality accident were analyzed for U (^{238,235,234}U) and Th (^{232,230,228}Th) isotopes to assess the possible contamination by U, based on the disequilibrium of the U-series nuclides. The concentrations of these nuclides and isotopic ratio (^{235}U/^{238}U) for a total of 39 samples were determined by alpha-spectrometry and ICP-MS, respectively. The radioactive equilibrium states of ^{238}U, ^{234}U and ^{230}Th were recognized for the most of samples measured. However, some soil samples collected near and/or far the conversion building showed impressive radioactive disequilibrium states. The ^{235}U/^{238}U atomic ratios for these samples were also notably higher than natural ratio, 0.720%. The consideration of excess amounts of ^{238}U, ^{235}U and ^{234}U for ^{230}Th suggested the contamination of land by U with various enrichments up to an about 7.2 %.

1C12 : Neutron fluence in the vicinity of criticality Accident Site in Tokai-mura : Evaluation by measurement of neutron-induced radionuclides

Hosotani, R., Nakanishi, T.[1], Imanaka, T.[2], Mitsugashira, T.[3], Hara, M.[3], Seki, R.[4], Sekine, T.[5], Kojima, S.[6] (Graduate School of Natural Sci.and Technol.,Kanazawa Univ., Fac. of Sci., Kanazawa Univ.[1], Res. Reactor Inst., Kyoto Univ.[2], Oarai-branch, Inst. for Material Res., Tohoku Univ.[3], Dep. of Chemistry, Tsukuba Univ.[4], Graduate School of Sci., Tohoku Univ.[5], Radioisotope Res. Center, Aichi Medical Univ. [6])

Residual neutron-induced radionuclides were measured in a soil sample and an iron sample collected in the vicinity of the location where a criticality accident occurred (in Tokai-mura, from 30 September to 1 October, 1999). Concentrations of Na-24, La-140, Sb-122, Fe-59, Sb-124, Sc-46, Zn-65, Mn-54, Cs-134 and Co-60 in the soil sample and Fe-59, Mn-54 and Co-60 in the iron sample were determined by γ-ray spectrometry. Neutron activation analysis, gravimetry, fluorescent X-ray analysis and absorption spectrophotometry were carried out for the determination of target elements in the samples. The measured values of radionuclide(Bq)/target-element were compared with calculated ones; the measured values were not well reproduced by the calculations. Anisotropy in neutron transport around the criticality accident site was obviously found.

1C13 : Fluence and energy spectrum of released neutrons from the JCO criticality accident site

Kojima, S., Imanaka, T.[1], Takada, J.[1], Mitsugashira, T.[2], Nakanishi, T.[3], Seki, R.[4], Kondo, M.[4], Sasaki, K.[5], Saito, T.[6], Yamaguchi, Y.[6], Furukawa, M.[7] (School of Medicine, Aichi Medical Univ., Res. Reactor Inst., Kyoto Univ.[1], Inst. for Materials Res., Tohoku Univ.[2], Fac. of Sci., Kanazawa Univ.[3], Dep. of Chemistry, Univ. of Tsukuba[4], School of Sci., Rikkyo Univ.[5], Radioisotope Res. Center, Osaka Univ.[6], Fac. of Environmental and Information Sci., Yokkaichi Univ.[7])

A criticality accident occurred at JCO Company Limited in Tokai-mura, Ibaraki Prefecture on September 30, 1999 and fission neutrons were continuously emitted for about 20 hours. Metal products and chemical reagents were collected at places with distances of 1.8-65 m and 270 m from the criticality accident site. Measurement of radionuclides induced from (n, gamma) and (n, p) reactions was attempted to estimate the fluences and the energy spectrum of released neutrons. These results will serve to evaluate the actual and more accurate doses of the personnel who had been exposed to neutrons in the Tokai-mura criticality accident.

1C14 : ^{36}Cl AMS measurement of JCO samples.

Arai, D., Seki, R., Nagashima, Y., Takahashi, T. (AMS Group, Univ. of Tsukuba)

A critical nuclear accident occurred at the nuclear fuel processing facility, JCO, in Tokaimura, Ibaraki prefecture, Japan on 30 September 1999. It was one of the most serious accidents in the history of nuclear power plants. Tremendous numbers of neutron particles were released. So, we have commenced to measure the yield of ^{36}Cl radioisotopes in the samples being collected from the accident site. The neutron flux can be estimated from the ratio of ^{36}Cl to ^{35}Cl because the ^{36}Cl nuclei are created from ^{35}Cl through a thermal neutron capture process, ^{35}Cl (n, γ) ^{36}Cl. A ^{36}Cl AMS techniques we have developed is the only available method for detecting very rare ^{36}Cl nuclei.

1C15 : AMS radiocarbon daing of ancient japanese documents and sutras

Oda, H., Masuda, T.[1], Yoshizawa, Y.[2], Fujita, K.[3], Nakamura, T., Furukawa, M.[4] (Nagoya Univ. Center for Chronological Res., Aichi Bunkyo Univ.[1], Emeritus Professor of Hiroshima Univ.[2], Coll. of Industrial Technol.[3], Fac. of Environmental and Information Sciences, Yokkaichi Univ.[4])

For radiocarbon dating of historical samples, the purpose is to clarify the historical age when the cultural property was produced as a tool. Radiocarbon age is, however, different from the historical age. The discrepancy between radiocarbon age and historical age becomes a more serious problem for recent samples which require more accurate age determination. The purpose of this study is to clarify the discrepancy concerning an ancient Japanese document. We measured radiocarbon ages of ancient Japanese documents and sutras, written dates of which are known from the paleographic standpoint. Most of the paper samples are from the obverse-side of the document and were used for writing characters or transmitting some information. Four paper samples were taken from sheets adhered to the back side of sutras for reinforcement. Radiocarbon dating with AMS has shown that the obverse-side paper of document has little discrepancy between the calibrated radiocarbon age and the historical age. Accordingly, such paper of ancient Japanese document or sutra is a suitable sample for radiocarbon dating of recent historic period. On the other hand, reinforcing paper has no clear relationship between both ages. Although the calibrated radiocarbon age could indicate when the sutra was repaired, it leaves room for further investigation because older paper could be stuck for repairing.

1C16 : Characteristics of particulate forms of radionuclides in the Chernobyl river waters.

Nagao, S., Matsunaga, T., Sanada, Y., Yanase, N., Nagano, T., Tokachenko, Y.[1], Amano, H. (Tokai Establishment, Japan Atomic Energy Res. Inst., RADEK[1])

The radioactive fallout derived from the Chernobyl accident heavily contaminated the exclusion zone (30 km zone) near the Chernobyl Nuclear Power Plant. After the accident, radioactive pollution originated from secondary contamination processes has been in progress. This study focuses on the migration behavior of particulate forms of radionuclides in the river systems because of understanding the transportation processes and pathways of the radionuclides. The suspended particles were collected from the water samples from Sahan and Pripyat Rivers in April 1997 to April 1999 by centrifuged method. The freezed-dry samples were measured for the gamma emitters such as ^{137}Cs by a well-type Ge-detector. The geochemical association of radionuclides in the suspended particles was investigated by sequential chemical extraction method.

1C17 : Determination of rhenium in environmental water samples by inductively coupled plasma mass spectrometry.

Tagami, K., Uchida, S. (Environmental and Toxicological Sci. Res. Group, National Inst. Radiological Sci.)

Because of its chemical similarities to Tc, Re can be used as a chemical analog for Tc-99 in the environment. However, Re is one of the rarest elements, and for this reason little is known of its geochemistry. In this study, a simple and rapid scheme is presented for determining Re in water samples by inductively coupled plasma mass spectrometry (ICP-MS). Three seawater samples were collected in Hitachinaka, Chiba and Kumatori. Five hundred milliliters of seawater sample was filtered through a 0.2-μm Millipore filter. After addition of nitric acid and hydrogen peroxide, the solution was boiled for 1 h on a hot plate. Then the solution was introduce to a TEVA spec resin column (Eichrom) to separate and concentrate Re. Almost 100% chemical recoveries of Re by the developed method were observed using Re-183 in multitracer solution. The Re fraction from TEVA resin column was diluted 20 times and measured its Re contents by ICP-MS. The instrumental detection limit for Re was 0.2 ppt. The Re contents in the Japanese seawater samples were 7-12.6 ppt.

1C18 : Determination of alpha nuclides in environmental samples using liquid scintillation measurement combined with pulse time interval analysis (TIA)

Uezu, Y., Maruo, Y., Komatsu, Y.[1], Hashimoto, T.[2] (Japan Nuclear Cycle Development Inst. Tokai Works, Graduated. School of Sci. and Technol., Niigata Univ.[1], Fac. of Sci., Niigata Univ.[2])

A liquid scintillation counting (LSC) combined with time interval analysis (TIA) has been developed for the determination of alpha emitting nuclides in environmental samples. TIA is based on the selective counting of the time intervals due to the successive alpha decay events within a millisecond time interval order. Lower Level Discriminator (LLD) setting of analog to digital converter (ADC) was adjusted to decrease background events due to a low energy alpha emitter ^{226}Ra. Furthermore, sample was bubbled by N_2 in order to eliminate the effects of Rn, its progenies and oxygen quenching effect. When LLD setting of ADC was applied from 20 to 3200, the total background event was decreased from about 270 to about 90 owing to the exclusion of ^{226}Ra. The decreasing procedure of background or random events was verified to cause the enhancement of detection sensitivity as well as the decrease of measuring error. Finally, the advanced TIA technique has been proven to be very preferable for the determination of successively correlated alpha emitters with short half-life in environmental samples.

2A01 : Synthesis of actinoids metallofullerenes using by radiotracer

Sueki, K., Akiyama, K., Zhao, Y. L., Sakaguchi, M., Kikuchi, K., Katada, M., Nakahara, H., Tsukada, K.[1], Nagame, Y.[1] (Graduate School of Sci., Tokyo Metropolitan Univ., Advanced Sci. Res. Center, Japan Atomic Energy Res. Inst.[1])

We investigated the synthesis of metallofullerene with actinoids (Th, Pa, U, Np, Pu, and Am) using by radiotracer and the HPLC behavior of their tracer. The elution behaviours were observed for the actinoids (Am, Np, U, Pa, and Th) containing fullerenes with 5PBB and Buckyprep columns. The results of elution curves indicate that new metallofullerenes containing actinoids have been synthesized.

2A02 : Characterization of actinide fullerenes.

Akiyama, K., Zhao Y-L., Sueki K., Kodama T., Suzuki S., Tsukada K.[1], Haba H.[1], Kikuchi K., Ohtsuki T.[2], Nagame Y.[1], Nakahara H., Katada M. (Dep. of Chemistry, Tokyo Metropolitan Univ., Advanced Sci. Res. Center, JAERI[1], Lab. of Nuclear Sci., Tohoku Univ.[2])

In this session, we report about the properties of chemically stable actinide fullerenes at the first time. These fullerenes were synthesized by arc discharge method and extracted by CS_2. These extracted materials were dissolved in toluene and separated by 2 step HPLC column separation using 5PBB column followed by Buckyprep column. The HPLC elution behavior of uranium fullerenes were similar to that of the fullerenes encapsulating light rare earth elements of La, Ce, Pr, and Nd. The most abundant component in the chromatogram was purified and identified by TOF/MS measurement. As the result, this was identified as U@C82. The UV/vis/NIR absorption spectrum of U@C82 was also measured, and found to be similar to that of Nd@C82 in which encapsulated Nd atom has f3 electronic structure same as U.

2A03 : Basic studies of alpha-recoil behavior in U and Th decay series using electrodeposited sources.

Morimoto, T., Banba. S., Hashimoto. T.[1] (Japan Chemical Analysis Center, Fac. of Sci.,Niigata Univ.[1])

Teflon ,silicon gum or glass collectors were irradiated with alpha-recoil atoms from a thinly electrodeposited ^{226}Ra source in a vacuum chamber of about 0.01MPa. The collectors were measured by alpha-spectrometry to determine the activity strength. The results showed that alpha-spectrum of each nuclide on the Teflon or silicon gum collector tailed. These findings imply that ^{222}Rn emitted from ^{226}Ra source moved in Teflon or Silicon gum collector more rapidly and easily than in glass. Glass collectors were irradiated using ^{232}U source. The results showed that ^{212}Bi/^{224}Ra activity ratio decreased gradually as the irradiation period was long. These findings imply that the behavior of ^{220}Rn, which was injected into the glass collector from ^{232}U source, was different from that of ^{220}Rn, which was produced from ^{224}Ra decay in the collector.

2A04 : Density functional study on hydration numbers of U(VI).

Yang, T. X., Tsushima, S., Suzuki, A. (Dept. Quantum Engineering and Systems Sci., Univ. of Tokyo)

Hydration number of U(VI) was studied using B3LYP hybrid density functional method. It was found out that the hydration number n=4 being the most stable for U(VI) in gas phase at 0 K and 0 atm pressure. When the calculation was carried out in solution (by including entropic effect and solvation energy), it was found out that n = 5 being the most stable for U(VI). The present study has shown that the entropic and solvation effects are quite important in studying the hydration numbers.

2A05 : Preparation of multitracer at KUR.

Takamiya, K., Akamine, M., Shibata, S., Kasamatsu, Y.[1], Toyoshima, A.[1], Shinohara, A.[1] (Res. Reactor Inst., Kyoto Univ., Graduate School of Sci., Osaka Univ.[1])

Radiochemical procedures for preparing multitracer using thermal neutron fission of ^{235}U were established. The target material of $^{nat}UO_2$ mixed with the catcher material for the fission products was irradiated at the research reactor of the Research Reactor Institute of Kyoto University. In this presentation, the catching efficiency for fission products correlated with the mixing ratio, the particle size and the sample shape will be reported.

2A06 : Tritium separation from heavy water by electrolysis.

Ogata, Y., Sakuma, Y.[1], Ohtani, N.[2] (Fac. of Medicine, Nagoya Univ., National Inst. for Fusion Sci.[1], Wakasawan Energy Res. Center[2])

Tritium separation from light and heavy water by electrolysis were carried out to estimate the separation characteristics of the tritium from heavy water. Solid polymer electrolysis, which needs no electrolyte, was used for the separation. The electrolysis currents were 5A, 10A and 20A. Hydrogen gas and oxygen gas produced were recombined under palladium catalyst. The separation coefficients were evaluated as the ratios of the tritium concentrations of the recombined water to the ones of the original water. The coefficients in light water were 9.64±0.07, and the coefficients in heavy water were 1.93±0.02.

2A07 : Construction of $^{225}Ac/^{213}Bi$ generator system and preparation of ^{213}Bi-labeled monoclonal antibody

Yamamoto, N., Washiyama, K., Takahashi, M., Tsuji, T., Terada, Y., Amano, R., Shiokawa, Y.[1] (Fac. of Medicine, Kanazawa Univ., Institute for Materials Research, Tohoku Univ.[1])

The Bismuth-213 is an alpha particle emitting radionuclide that was expected to use of alpha-immunotherapy. The physical advantage using of alpha particles for radioimmunotherapy are that high-LET (Liner Energy Transfer) that are required for single-cell kill and short range (60 μm). In this work, a method of construction of an $^{225}Ac/^{213}Bi$ generator system, elution of the daughter ^{213}Bi nuclide and preparation of its radioimmunoconjugate was examined as follows. 1. An ^{225}Ac source provided from the Institute of Material Sciences, Tohoku University were employed. 2. A best condition of loading the $^{225}Ac/^{213}Bi$ on cation exchange column was 0.01 to 0.1N HCl and of elution the ^{213}Bi was 0.02 to 0.06N HCl/0.05 to 0.1M KI mixing solution. 3. The system of ^{213}Bi elution with high radiochemical yield was established every 5 hours milking. 4. The synthesis of ^{213}Bi with monoclonal antibody and isothiocyanobenzyl-EDTA conjugate were also examined by using the antibody as Fab produced by mouse polyclonal IgG.

2A08 : Reaction of a nitrido rhenium complex $[ReNCl_2(PPh_3)_2]$ with an amine oxime:Comparison with nitrido techneium complexes.

Iwasawa, T., Takayama, T., Sekine, T., Kudoh, H. (Graduate School of Sci.Tohoku Univ.)

The reaction of $[ReNCl_2(PPh_3)_2]$ with an amine oxime PnAO(3,3,9,9-tetramethyl-4,8-diazaundecane-2,10-dione dioxime) was performed in dichloromethane-ethanol solution. The products were characterized by ^1H and ^{13}C-NMR spectroscopy, IR spectroscopy, and mass spectrometry. The complexwas revealed to have an ocatahedral structure in which two PnAO ligands were coordinated to the dioxo rhenium core through two amine nitrogen atoms. This result indicates that the nitrido rhenium core is less stable than the nitrido technetium core in ligand exchange reactions.

2A09 : Synthesis of a novel nitrido technetium complex with peptide chelate ligand and its structure in a solution.

Sato, S., Takayama, T., Sekine, T., Kudoh, H. (Graduate School of Sci.Tohoku Univ.)

A novel nitrido complex with peptide chelate ligand was synthesized by a reaction of pentapeptide KYCAR and $[n\text{-}Bu_4N][TcNCl_4]$ in methanol. The complex was charcterized by ^1H and ^{13}-NMR spectroscopy, IR spectroscopy, and elemental analysis. The complex in a solution was revealed to have a square pyramid structure in which two KYCARs were coordinated to the technetium center through the nitrogen atom and deprotonated sulfur atom of cysteine, the coordinated nitrogen and sulfur atoms being in the trans position each other.

2A10 : Solvation number of Tb(III) in a mixed system of DMSO and water.

Watanabe, T., Kawasaki, M., Yanaga, M., Suganuma, H., Satoh, I.[1], Yaita, T.[2], Takai, K.[2], Narita, H.[2], Suzuki, S.[2], Tachimori, S.[2] (Graduate School of Sci. and Engineering, Shizuoka Univ., Inst. for Materials Res., Tohoku Univ.[1], Japan Atomic Energy Res. Inst.[2])

The hydration numbers of tripositive lanthanide ion are dependent on their ionic radii. It was elucidated by some chemists that the hydration number of Tb^{3+} was 8. The donor number of DMSO is larger than that of water and DMSO molecule also bulkier than water. So it may be expected for the solvation number of Tb^{3+} to vary from 8, when the mole fraction of DMSO (X_S) in a mixed system of DMSO and water increases. We studied the variation in the solvation number of Tb^{3+} with an increase in Xs in the mixed system by (1) solvent extraction method and (2) EXAFS. It was derived from the obtained results that the solvation number of Tb^{3+} was kept to 8 in the region of $0 \leqq X_S \leqq 0.203$.

2A11 : Molecular dynamical study on hydration of U(IV).

Imai, H., Yang, T. X., Tsushima, S., Suzuki, A. (Dept. Quantum Engineering and Systems Sci., Univ. of Tokyo)

Hydration of U(IV) was studied by molecular dynamical (MD) simulations. The U-H pair potential was locally developed by density functional calculations and was used in MD simulations. The effect of effective charge of uranium on the U-O bond length was also investigated in this study.

2B01 : Transmission and emission Mössbauer spectra of (Sr,Ca)(Fe,Co)O_{3-d}

Nomura, K., Sawada, T., Homonnay, Z.[1], Juhasz, G.[1], Vertes, A.[1] (School of Engineering, Univ. of Tokyo, Dep. of Nuclear Chemistry, Eotvos Lorand Univ.[1])

Emission and transmission Mössbauer spectra of $(Sr_{0.95}Ca_{0.05})(Fe_{0.5}Co_{0.5})_{3-d}$ and $(Sr_{0.5}Ca_{0.5})(Fe_{0.5}Co_{0.5})O_{3-d}$ were measured, and the difference of coordinated oxygens number between Fe atoms and Co atoms was recognized. It is found that Co ions is prefer to terahedral rather than octahedral sites, whereas Fe ions are located at terahedral and octahedral sites at the same amounts.

2B02 : In-situ ^{57}Fe Mossbauer-spectral measurements of lithium insertion materials for advanced batteries

Ariyoshi, K., Ohzuku, T., Sakai, Y.[1] (Fac. of Engineering, Osaka City Univ., Daido Kougyou Technol.[1])

Lithium-insertion materials containing iron species were prepared and examined by XRD, electrochemical, and Mossbauer-spectral methods. The solid-state redox potentials due to iron species were observed for $LiFe_{1/2}Mn_{3/2}O_4$ and $LiFeTiO_4$, while solid-state redox potential of $LiFe_{1/4}Ni_{3/4}O_2$ was almost the same as that of $LiNiO_2$. The Mossbauer spectra clearly showed that 5 V redox potential for $LiFe_{1/2}Mn_{3/2}O_4$ was due to the formation of tetravalent iron species, and 2 V redox potential for $LiFeTiO_4$ was due to the formation of divalent iron species. Although tetravalent iron species was observed in the spectra for the fully oxidized $LiFe_{1/4}Ni_{3/4}O_4$, the solid-state redox potential of iron species could not be specified. As were described here, in-situ Mossbauer-spectral measurements of lithium-insertion materials were quite useful in developing solid state electrochemistry of insertion materials for advanced batteries.

2B03 : ^{57}Fe Mossbauer spectroscopic studies of paleosol

Nakada, M., Utsunomiya, S.[1], Itoh, J.[1], Murakami, T.[1] (Dep. of Materials Sci., JAERI, Fac. of Sci., Univ. of Tokyo[1])

The purpose of this study is to estimate the old times atmosphere and to elucidate the weathering process of rocks. ^{57}Fe Mössbauer spectroscopy is useful tool to study chemical states of iron. We applied ^{57}Fe Mössbauer spectroscopy to paleo-weathered rocks (paleosol). The paleosol was developed before 2.48 Ga at Cooper Lake, Ontario, Canada. A relative intensity of divalent iron measured by Mossbauer spectroscopy decreased from lower portion toward upper portion of paleosol.

2B04 : Effect of cation symmetry and intermolecular interaction in binuclear ferrocene derivatives

Oda, T., Nakashima, S.[1], Okuda, T. (Graduate school of Sci., Hiroshima Univ., Radioisotope Center, Hiroshima Univ.[1])

Mixed-valence binuclear ferrocene derivatives substituted with 2-phenylbutyl group having asymmetric carbon were prepared and studied to compare the mixed-valence states of these isomers by means of ^{57}Fe Moessbauer spectroscopy.(*S,S*) and (*R,R*) compounds showed typical trapped-valence state at 80K. Although two valence states corresponding to Fe(II) and Fe(III) approached each other with increasing temperature, they never showed perfect detrapped-valence state even at room temperature. It can be explained by the fact that they do not have inversion center in themselves. On the other hand, racemic compound which consists of equimolar (*S,S*) and (*R,R*) compounds showed detrapped-valence state at lower temperature.

2B05 : Molecular motion and phase transition of 2-phenylbutylferrocene enclathrated in deoxycholic acid.

Ichkawa, N., Nakashima, S.[1], Okuda, T. (Graduate School of Sci., Hiroshima Univ., Radioisotope Center, Hiroshima Univ.[1])

^{57}Fe Moessbauer spectroscopy was applied to know the difference in interaction between host and guest molecules among (*R*)-, (*S*)-, and racemic isomers in 2-phenylbutylferrocenes enclathrated in deoxycholic acid (DCA). The (*S*) isomer-DCA has one solvated molecule per guest molecule, racemic isomer-DCA 0.7molecule of solvated molecule, while (*R*) isomer includes none of solvated molecule. ^{57}Fe Moessbauer spectroscopy revealed that (*R*) isomer-DCA changes in the lattice vibration around 160K, while (*S*) isomer-DCA does not. There was a difference in the powder X-ray diffraction patterns among them. An interesting phase transition was observed in (*S*)- and racemic isomers-DCA, which is accompanied by a desolvation and then the change of crystal structure to that of (*R*) isomer-DCA heated up to the same temperature. Such phase transition was not observed in (*R*) isomer-DCA.

2B06 : Synthesis and Moessbauer spectroscopic studies of iron pyridinedicarboxylates and their thermal decomposition products

Katada, M., Afroj, D., Yamauchi, T., Sawada, M. (Graduate School of Sci., Tokyo Metropolitan Univ.)

Several types of iron pyridinedicarboxylates were synthesized by maintaining equimolar mixtures of pyridindicarboxylic acids and $FeCl_2 4H_2O$ and $FeCl_3 6H_2O$ and studied by Moessbauer spectroscopy and TG-DTA thermalanaysis. Moessbauer spectra of the complexes prepared with $FeCl_2 4H_2O$ under nitrogen atmosphere showed that all the complexes were octahedral high-spin iron(II) state. However, the iron(II) complexes prepared in air were high-spin iron(III) state except for 2,5-pyridinedicarboxylic acid iron complex. Crystal structure of iron(III) complex with 2,6-pyridinedicarboxylic acid was dependent on the condition of preparation.

2B07 : ^{57}Fe Moessbauer spectra of non-planar-porphirinatoiron(III) complexes.

Takahasi, M., Ikeue, T.[1], Nakamura, M.[1], Takeda, M. (Dep. of Chemistry, Toho Univ., Dep. of Chemistry, Toho Univ. School Medicine[1])

^{57}Fe Moessbauer spectra for octaethyltetraphenylporphirinatoiron(III) complexes, Fe(oetpp)Cl or Fe(oetpp)L_2.ClO_4 (L=thf, py, 4-CN-py, 4-(Me_2N)-py) are measured. While the thf complex, Fe(oetpp)$(thf)_2$.ClO_4, shows the pure intermeidate spin state (S= 3/2) above 80 K, a spin-admixed (S = 1/2, 3/2) state is observed for the py complex. A complex electronic state for 4-CN-py complex is suggested. The spin states for Fe(oetpp)Cl and Fe(oetpp)$(dmap)_2$.ClO_4 are confirmed to be high spin and low spin, respectively.

2B08 : Mossbauer study on matrix-isolated iron halides.

Yamada, Y. (Fac. of Sci, Sci. Univ. of Tokyo)

Laser ablation is a very useful and convenient technique to vaporize materials which are hardly vaporized using resistive heating. Furthermore, laser ablation provides new chemical interest as it produces highly energetic atoms, which react with variety of molecules and form novel compounds unavailable under normal conditions. Iron halide species were produced by the reaction of laser-evaporated iron atoms with halogenated reactant gas, and were isolated in low-temperature matrices. Their Mossbauer spectra were obtained. Fe_2F_6, FeF_3 and Fe_2F_4 were produced by the reaction of laser-evaporated iron atoms with sulfur hexafluoride SF_6. FeI_2 and dimeric Fe_2I_4 were produced by the reaction of laser-evaporated iron atoms with methyl iodide CH_3I. The yields of the products varied depending on the concentration of reactan gas in the Ar matrix. Molecular orbital calculations were performed in order to confirm their assignments.

2B09 : Optical switching of iron(III) compounds.

Hayami, S., Gu, Z., Fujishima, A.[1], Sato, O. (Kanagawa Acad. of Sci. and Technol., Fac. of Engineering, Univ. of Tokyo[1])

One of the main challenges in the field of spin-crossover complexes is the production of compounds with wide thermal hysteresis at room temperature. We have found out that $[Fe(qsal)_2]NCSe \cdot CH_2Cl_2$ displays the widest thermal hysteresis for the spin-crossover compounds. Furthermore, it was found that the compound exhibits light-induced excited spin state trapping (LIESST) effects at low temperature by exciting the ligand to metal charge transfer band. It is thought that the cooperativity responsible for the large hysteresis arises mainly from the intermolecular p interactions between quinoline and phenyl rings.

2B10 : Direction of spin alignment in oxalate-bridged magnetic materials.

Iijima, S., Mizutani, F. (National Inst. of Biosci. and Human-Technol.)

The direction of spin alignment was investigated for oxalate-bridged bimetallic complexes $A[Mn(II)Fe(III)(ox)_3]$ by using ^{57}Fe Moessbauer spectroscopy. It was observed that the direction can be controlled by the kinds of the organic cation A^+. The differences in crystal structure would be responsible for the direction change. Similar results were also obtained for the system of $A[Ni(II)Fe(III)(ox)_3]$.

2B11 : Magnetic and photochemical studies of $[Fe(pap)_2]X{\cdot}S$

Maruta, T., Maeda, Y., Hayami, S.[1], Sato, O.[1] (Graduate school of Sci., Kyushu Univ., Kanagawa Acad. of Sci. and Tech.[1])

As a research of iron(III) complexes which trigger off light-induced excited spin-state trapping (LIESST) phenomenon, we synthesized iron(III) complexes $[Fe(pap)_2]X{\cdot}S$ and studied magnetic and photochemical properties. The ^{57}Fe Mössbauer and variable-temperature magnetic susceptibility data for the complex $[Fe(pap)_2]PF_6{\cdot}H_2O$ showed the spin-crossover behavior. And data for the complex $[Fe(pap)_2]PF_6{\cdot}DMSO$ also showed the spin-crossover behavior. During 5 K to 50 K, LIESST was observed for $[Fe(pap)_2]PF_6{\cdot}DMSO$ complex.

2C01 : Basic study on selective separation of tritium (1) -separation of water-

Akahori, S., Tega, E., Shimada, A., Okuno, K., Sasaki, S.[1], Suzuki, T.[1], Kondo, K.[1] (Radiochemistry Res. Lab., Fac. of Sci., Shizuoka Univ., High Energy Accelerator Res. Organization(KEK)[1])

For preservation of the environment around high-energy accelerator facilities, it becomes more and more important to establish an effective technique for measurements of tritium released from the stacks and the beam-line tunnels. A new method for real-time and continuous monitoring of tritium has been proposed and developed using hollow-filament type polyimide membranes in our group. Tritium is formed in air mainly by spallation of oxygen and nitrogen in the beam-line tunnels. At the same time, the other radioisotopes are also produced in the tunnels, and those short-lived radionuclides interfere with direct measurements of tritium. Therefore, the separation of tritium from such radioactive airbornes would be essential for continuous and real-time measurements of tritium. Among several methods of tritium separation, a hollow-filament type polyimide membrane is one of the most promising devices because of its high separation efficiency with low cost. In the present study, the experiments have been performed using a small membrane module system without tritium in order to investigate its basic performances of the membrane. We have measured the enrichment factors of hydrogen isotopes in nitrogen and air, and proceeded with experiments for water separation.

2C02 : Removal of impurities from environmental water samples for tritium measurement by means of liquid scintillation counter

Sakuma, Y., Ogata, Y.[1], Tsuji, N.[2] (National Inst. for Fusion Sci, Fac. of Medicine, Nagoya Univ.[1], Japan Air-conditioning Serv. Co. Ltd.[2])

Liquid scintillation counting is now the most popular method to measure the tritium concentration in the environmental water. The tritium concentration in the environmental samples became as low as the detection limit of low background of the liquid scintillation counter; 0.5-1.0 Bq/kg-H_2O. So we applied an electrolysis enrichment. The electrolysis using a solid polymer electrolyte was chosen to enrich, which did not need to add any electrolyte and also the neutralization later. However, it takes much time with a lot of doing to distill off the impurities in the sample water before and after the distillation. In the light of it we investigated into the possible alternative method with membrane filters for purification. As a result, the filtration was proved to be available for tritium measurement.

2C03 : Behavior of Sr, Cs, and Ba in the culture solutions

Kakiuchi, H., Amano, H., Ichimasa M.[1] (Dep. of Environmental Sci., Japan Atomic Energy Res. Inst., Fac.of Sci., Ibaraki Univ.[1])

The roles of microbial activities need to be examined in a part to play in the material circulation. In this research, it was examined that the environment factors (nutrients and pH) influence the retention of Sr, Cs, and Ba as analogue of long lived radionuclide by the microorganism. The study on the effect of pH and initial metal (Sr, Cs and Ba) concentration on retention of metals by microorganism inoculated from surface soil. The cultures under coexistence of Sr, Cs, and Ba (10 ppm) in 1% PTYG for 5 days, and the products were filtered with the polypropylene filter. The attached component with cells was found to contain most of the retained cations. One of the microorganism was made strontium carbonate soluble under the supersaturated culture solution with excess strontium carbonate.

2C04 : Application of radionuclides for speciation of organic matter in seawater

Hirose, K. (Geochemical Res. Dep., Meteorological Res. Inst.)

The interaction between thorium and oceanic particulate matter was examined experimentally by using chemical equilibrium techniques. Thorium reacts quatitatively with the organic binding site of Particulate Matter (PM) in 0.1 M HCl solution by complexation, which is equilibrated within 24 h. According to mass blance analysis, thorium forms a 1:1 complex with a organic binding site in PM, whose conditional stability constant is $10^{6.6}$ M^{-1}. The Th adsorption ability is present even 6.9 M HCl solutions although the amount of Th adsorption decreases with increasing acidity in the solution. Interferences to Th adosrption by Fe(III) suggest that other metals cannot react with PM in more than 0.1 M HCl solutions when concentrations of other metals are the same level of Th. The competitive reaction between Th and Fe(III) occurs in higher Fe concentrations, which means that the organic binding site is nonspecific for Th. A vertical profile of the strong ligand of PM in the western North Pacific is charactrized; that is, the strong ligand shows a surface maximum and decreased rapidly with depth.

2C05 : Multitracer screening: Element-element interaction in mouse brain under deficient and over-loaded state of an essential trace element

Yabushita, Y., Kanayama, Y., Kimura, T., Tarohda, T.[1], Washiyama, K., Amano, R., Enomoto, S.[2] (Fac. of Medicine, Kanazawa Univ., Graduate School of Natural Sci. and Technol., Kanazawa Univ.[1], Inst. of Physical and Chemical Res.[2])

Multitracer technique is useful and versatile for the study on bio-trace elements. The technique was applied to screen simultaneously the brain regions (cerebral cortex, corpus striatum, hippocampus, cerebellum, thalamus and hypothalamus, midbrain, pons and medulla, olfactory bulb) uptakes of 6 radioactive ^{75}Se, ^{83}Rb, ^{54}Mn, ^{65}Zn, ^{58}Co and ^{46}Sc tracers in the mice maintained on an essential element deficient diet or its overloaded diet. As a result, the radioactive distributions of ^{58}Co and ^{46}Sc were variable and region-specific in the brain, while those of ^{75}Se, ^{83}Rb, ^{54}Mn, and ^{65}Zn were comparable among all regions. Much information about the element-element interactions in the brain was obtained and summarized in this work. For example, the regional uptakes of ^{46}Sc by cerebral cortex, pons and medulla were found higher than those by other regions in mice maintained Mn overloaded diet. The homeostasis of some trace elements (Mn, Zn and Se) in the mouse brain was discussed on their essentialities and biochemical roles in the brain function.

2C06 : Biobehavior and concentration of trace elements in brain of normal mice during development. -An application of multitracer and neutron activation

Tarohda T., Yabushita Y.[1], Amano R.[1], Nakanishi T.[2], Enomoto S.[3] (Graduate School of natural Sci. and technol., Kanazawa Univ., School of Health Sci., Fac. of Medicine, Kanazawa Univ.[1], Dep. of Chemistry, Fac. of Sci., Kanazawa Univ.[2], Inst. of Physil and Chemical Res.(RIKEN)[3])

We studied the relationship between behavior and concentration of selenium, zinc and manganese in brain. They were conducted to make use of multitracer technique and neutron activation analysis. The multitracer technique was applied to some studies on the Biobehavior of trace elements in normal ICR mice. Comparative behavior(^{75}Se, ^{65}Zn, ^{54}Mn behavior) and concentration (Se, Zn, Mn content) were examined in the brain of 1 day old, 4 day old, 8 day old, 21 day old and 56 day old mice, and evaluated in terms of brain uptake rate (the radioactivity percentage of injected dose per gram of interested organ, %dose/g) and brain concentration (μg/g). As a result, the uptakes of all 3 tracers by the brain of 1-day-old mice were found much higher than those of other elder ones. Brain concentration of Se and Zn hardly changed. But concentration of Mn in brain was increasing with growth. We examine here these findings by means of radiochemical technique.

2C07 : Specific behavior of trace elements in Zn-deficient mice.

Ohyama, T., Yanaga, M., Yoshida, T., Maetsu, H., Noguchi, M., Suganuma, H., Omori, T., Hirunuma, R.[1], Enomoto, S.[1] (Fac. of Sci., Shizuoka Univ., Inst. of Physical and Chemical Res.(RIKEN)[1])

We used a multitracer technique in order to determine uptake rates of essential trace elements in various organs and tissues of Zn-def. mice. Eight-week old male mice of ICR strain were divided into two groups. One group was fed with Zn-def. diet and distilled water, and the other group with control diet and the same water. After a week, multitracer solution separated from Ag target was injected intraperitonealy or orally administered to each mouse. Various organs and tissues were removed 6-72 hours after administration, and weighed immediately. Their radioactivity levels were measured with HP Ge detectors. We compared uptake rates of these radioisotopes with concentrations of trace elements determined by instrumental neutron activation analysis in order to consider why Zn-deficiency leads specific metabolism for trace elements. In mice undergone intraperitonealy injection, there were no differences in uptake rate of Co in various organs between Zn-def. mice and control ones, whereas Co concentrations in all the organs and tissues of Zn-def. mice were higher than those of control mice. On the other hand, in mice undergone oral administration, Co uptake rates of Zn-def. mice were higher than those of control ones. There were no differences in uptake rates of other elements.

2C08 : Influence of maternal zinc deficiency on trace elements in lactating female mice.

Yoshida, T., Kamaya, M., Inukai, K., Maetsu, H., Ohyama, T., Yanaga, M., Noguchi, M.[1], Suganuma, H., Omori, T. (Radiochemistry Res. Lab., Fac. of Sci., Shizuoka Univ., Dep. of Biology and Geosciences, Fac. of Sci., Shizuoka Univ.[1])

We investigated the influence of maternal zinc deficiency during lactation period on the behavior of trace elements in various organs and tissues of mice. The mice lactating to their pup were fed with Zn-deficient diet or control diet for 3 weeks from 3 days after childbirth. Concentration of twelve elements, Na, Mg, Cl, K, Ca, Mn, Fe, Co, Zn, Se, Br and Rb in liver, kidney, pancreas and bone, were determined by instrumental neutron activation analysis. Mean body weight of Zn-deficient lactating mice was lower than control mice, whereas such trend was not observed for non-pregnant female mice. On the other hand, their pup were showed symptoms of zinc deficiency, such as growth retardation and alopecia. Zinc concentration in liver of Zn-deficient mice was not distinctly lower than that of control mice. However zinc concentration in bone of Zn-deficient mice was significantly decreased. It is concluded that maternal zinc deficiency during lactation period may cause more serious damage to metabolism of trace elements and other materials in the organs and tissues of lactating female themselves and their pup.

2C09 : Kinetic study on the protective effect of four green tea catechins against DNA strand breaks induced by radiation.

Ohashi, Y., Konishi, M., Yoshioka, H., Yoshioka, H.[1] (Radiochemistry Res. Lab., Fac. of Sci., Shizuoka Univ., Inst. for Environmental Sci., Univ. of Shizuoka[1])

Protective effects of four green tea catechins ((-)-epicatechin, EC; (-)-epigallocatechin, EGC; (-)-epicatechin gallate, ECg; (-)-epigallocatechin gallate, EGCg) against DNA strand breaks induced by Co-60 gamma ray and H-3 beta ray were investigated. Reactive oxygen species (ROS) such as hydroxyl radical were produced by radiolysis of water and induced DNA strand breaks. However, in the presence of green tea catechins, competing reaction between DNA and tea catechins against ROS was occurred and DNA scission was reduced. We calculated rate constants of the reactions between ROS and each tea catechins and compared these values. The values of four catechins were different, depending on their chemical structures.

2C10 : Comparison on radical scavenging activity of four tea catechins by ESR solid-state spin trapping method

Konishi, M., Ohashi, Y., Kawasaki, M., Yoshioka, H., Hase, H.[1], Yoshioka, H.[2] (Radiochemistry Res. Lab., Fac. of Sci., Shizuoka Univ., Res. Reactor Inst., Kyoto Univ.[1], Inst. for Environmental Sci., Univ. of Shizuoka[2])

Reactivity of tea catechins, (-)-epicatechin (EC), (-)-epigallocatechin (EGC), (-)-epicatechin gallate (ECg), (-)-epigallocatechin gallate (EGCg), with OH radical generated by radiolysis of water at 195 K was examined by using solid-state spin trapping method. The results were compared with those obtained by the spin trapping method at room temperature by using strong gamma-irradiation. The ratios of the reactivity of four catechins with various radicals were compared and the change of the ratio was discussed from the viewpoint of the stability of the radicals.

2C11 : Elucidation of the ion recognition mechanism by calixarene (I)

Shimada, A., Okuno, K., Narita, K.[1], Yaita, T.[1], Tachimori, S.[1] (Fac. of Sci., Shizuoka Univ., Japan Atomic Energy Res. Inst.[1])

The extraction behavior of the alkaline metal(Rb, Cs) from nitric acid solutions by the calixcrown was studied. The distribution ratios of these metals increased with an increase in nitric acid concentration. And the plot of the distribution ratio vs. the concentration of calixcrown gives a straight line that has a slope 1. The results suggested that a calixcrown formed complex with a metal. In this lecture, we will also mention the relationship between the selectivity and the structural results obtained by EXAFS.

3P01 : Neutron activation analysis of rock samples for trace U, Th, and lanthanoids

Chai, Jy., Oura, Y., Ebihara, M., Hara, M.[1], Mitsugashira, T.[1] (Gradiate School of Sci. Tokyo Metropolitan Univ., Inst. of Materials Res. Tohoku Univ.[1])

As Th and U are the least abundant elements in our solar system (0.0335 for Th and 0.0090 for U (atoms/10^6 Si); Anders and Grevesse, 1989), an analytical method with high sensitivity for these elements is to be applied to meteorite samples. For determining ultra low contents of REE, a contribution of neutron induced fission products of U often becomes serious. In order to correct such a contribution property, both U and REE contents need to be obtained for the same irradiated sample. In this study, we developed a RNAA method to determine ultra low U, Th, and REE in the same meteorite samples.

3P02 : Charged particle activation analysis of oxygen in fluoride and chalcogenide glasses used for fiber amplifier

Shikano, K., Nishida, Y.[1], Kobayashi, K.[1], Kanamori, T., Shimizu, M., Masumoto, K[2], Ohtsuki, T.[3], (NTT Photonics Lobs., NEL[1], KEK[2], Lab. of Nucl. Sci., Tohoku Univ.[3])

We studied interfering nuclear reactions with glass matrices to determine the oxygen concentration in fluoride and chalcogenide glasses by proton activation analysis. By using substoichiometric separation for ^{18}F after irradiation, we found that the oxygen concentration was 12 to 204 ppm in InF_3-based fluoride glass and 0.04% to 0.7% in sulfur chalcogenide glass. We also studied the relation between oxygen concentration and optical properties.

3P03 : Determination of trace elements in liver, serum and plasma of mice by means of PIXE analysis.

Yanaga, M., Yoshida, T., Maetsu, H., Noguchi, M., Omori, T., Futatsugawa, S.[1], Sera, K.[2] (Fac. of Sci., Shizuoka Univ., Nishina Memorial Cyclotron Center, Japan Radioisotope Assoc.[1], Cyclotron Center, Iwate Medical Univ.[2])

Concentrations of various trace elements in livers and sera of Zn-deficient mice and control mice were determined by PIXE analysis. Seven elements, P, S, K, Fe, Cu, Zn and Rb, in liver and 12 elements, Na, Mg, P, S, Cl, K, Ca, Fe, Cu, Zn, Se and Br, in serum were satisfactory determined. Low Zn concentration was found in sera of Zn-deficient mice although no significant differences between two groups of mice were recognised for the other elements in sera. Copper concentration in livers of Zn-deficient mice was slightly decreased with decreasing Zn concentration. On the other hand, high Fe concentration was found in livers of Zn-deficient mice.

3P04 : Inductive recovery from Zn-deficiency symptoms by zinc administration

Maetsu, H., Inukai, K., Kamaya, M., Yoshida, T., Ohyama, T., Yanaga, M., Noguchi, M., Suganuma, H., Omori, T. (Radiochemistry Res. Lab., Fac. of Sci., Shizuoka Univ.)

Variation in the concentrations of Zn and other trace elements in mice that suffered Zn-administration subsequent to Zn-deficiency were investigated for three different stage in growing periods. The 3-day, 4-week and 8-week old mice were fed with Zn-deficient diet pellets for 3 weeks. After that, their diet was exchanged to control diet in which zinc carbonate was added. Three weeks later, their liver, pancreas, testis and bone, were removed. They were freezed-dried and subjected to the INAA. Concentrations of trace elements in these organs were compared with those of mice which were fed with only Zn-deficient diet or control diet through 6 weeks as control. Zinc concentration or Co concentration in bone of all series of Zn-deficient mice was distinctly lower or higher than these of the control diet mice, respectively. On the other hand, supplying Zn-contained diet to Zn-deficient mice, Zn concentration in their bones became increased and Co concentrations in them did decreased significantly. However, the recovery grades of Zn and Co concentrations were found to be dependent on age, especially in bone of the Zn-administrated mice.

3P05 : Radiochemical analysis of P-32 in conjunction with solvent extraction and liquid scintillation counting

Liyanage, J. A., Yonezawa, C. (Japan Atomic Energy Res. Inst.)

Radiochemical analysis method for P-32 has been studied to determine trace amounts of phosphorus, which is an important element in life, material and environmental sciences by neutron activation analysis. To measure the radioactivity of P-32 existing in radionuclides by liquid scintillation efficiently, solvent extraction of phosphomolybdate compound with tri-n-octylamine and xylene has examined and high sensitive radiochemical analysis method has been established.

3P06 : The development of the k_0 standardization neutron activation analysis in the inter-university laboratory for the joint use of JAERI facilities

Sawahata, H., Kawate, M., Ito, Y. (Univ. of Tokyo, Res. Center for Nuclear Sci. and Technol.)

Introduction of the k_0 standardization neutron activation analysis at the Inter-University Laboratory is nearly ending. The parameters of many of the irradiation channels of JRR-3M, JRR-4 and those of our several SSDs are determined. The analytical results obtained sing the k_0 system for some combinations of the irradiation channels and detectors are presented. Some commercial standard samples were measured. It is shown that the k_0 standardization system can produce fairly excellent results in view of the agreements with the certified values.

3P07 : The two detector auto sample changer system for INAA in the inter-university laboratory for the common use of nuclear facilities

Kawate, M., Sawahata, H., Ito, Y. (Univ. of Tokyo, Res. Center for Nuclear Sci. and Technol.)

A new Auto Sample Changer system is being made at the Inter-University Laboratory for the Common Use of Nuclear Facilities. The sample storage chamber can contain 42 samples and two gamma ray spectrometers, one with high detection efficiency and the other with high resolution for low energy photons, can be selected. The low energy high resolution spectrometer is especially useful when miss-identification of the gamma-rays is possible. The construction and the characteristics of the system is reported.

3P08 : About the stability of neutron flux in the pneumatic tube Irradiation channel of J RR - 4

Sawahata, H., Kawate, M., Ito, Y., Fukuoka, T.[1], Ebihara, M.[2] (Univ. of Tokyo, Res. Center for Nuclear Sci. and Technol., Fac. of Geo-environmental Sci., Rissho Univ.[1], Fac. of Sci., Tokyo Metropolitan Univ.[2])

Stability of the thermal neutron flux at the pneumatic tube of JRR-4 was measured as a function of time during its low power operation of 100 kW. The low power operation is the particular demand by many NAA users recently. The fluctuation of the thermal neutron flux was with in 3 % during a daily operation hours. However a step-wise change of the flux sometimes occurs due to rapid operation of the control rods. It is important to get information about such possible change from the reactor operator.

3P09 : Spectral profiles of X-rays and low energy γ-rays accompanied by neutron capture.

Minai, Y., Yonezawa, C.[1], Matsue, H.[1], Kubo, M. K.[2] (Nezu Inst. of Chemistry and Fac. of Humanities, Musashi Univ., Japan Atomic Energy Res. Inst.[1], School of Sci., Univ. of Tokyo.[2])

Spectral profiles of X-rays and γ-rays emitted from the radionuclides generated by neutron capture were determined in order to evaluate the lines opt to elemental analysis. Those spectra were recorded, using the prompt γ-ray analysis system at the JRR-3M at JAERI, Tokai. Use of the Compton suppression mode was beneficial to minimize the noise level in such low energy region. The spectral profiles of X-rays emitted from europium compounds in lower energy region were recorded by a PIN diode Si detector. Relations between the intensity ratios of the X-rays and oxidation states or the binding atom were carefully investigated in order to evaluate the chemical effects of the emission.

3P10 : Determinationm of extractable organohalogens (EOX) in Brown Booby (Sula leucogaster) collected at Nakanokamishima island by instrumental neutron activation analysis

Kawano, M., Kohno, H.[1], Wakimoto, T. (Fac. of Agriculture., Ehime Univ., Okinawa Regional Res. Center, Tokai Univ.[1])

Many investigations have been carried out on man-made organochlorine compounds in the marine environment. They are accumulated in higher trophic organisms through marine food chain. The present study was primarily designed to investigate the relationship between the amounts of known compounds such as PCBs, DDTs, CHLs, HCHs and HCB and of organically bound halogens (OBH) residued in brown booby (Sula leucogaster) collected at Nakanokamishima Island, South Ryukyus, Japan. The individual compounds were analysed by GC-MS and GC-ECD, and OBH were measured as extractable organohalogens (EOX) by instrumental neutron activation analysis. It is possible to get figures for the concentration of unknown compounds by subtracting those of the known compounds (PCBs, DDTs, CHLs, HCHs and HCB) from those of EOX. They contributed less than 10% of EOCl residued in the organisms. This is implies that a large part of EOX is composed of unknown compounds.

3P11 : Fundamental investigation and measurement of trace elements in tree rings using INAA.

Aoki, T., Ko, S.[1], Takada, J.[2], Katayama, Y.[1] (Radioisotope Res. Center, Kyoto Univ., Graduate school of Agriculture, Kyoto Univ.[1], Res. Reactor Inst., Kyoto Univ.[2])

Trace elements in tree rings were measured by INAA, and also measured by ICP-MS and PIXE. Radial distribution profiles of 18 elements against growth year in sakura stem samples were determined by INAA. The concentration of Mn was determined by three methods: INAA, ICP-MS and PIXE, and the concentrations of Zn and Al were determined by INAA and ICP-MS alone. The profiles obtained by INAA were compared to those obtained by the two other methods. The profile of Mn obtained by INAA was similar to the profiles obtained by ICP-MS and PIXE. The concentration of Mn gradually increased from the cambium towards the pith from around 10 to 30 ppm. The radial distribution profile of Zn obtained by INAA was also similar to the profile obtained by ICP-MS. The concentration of Zn was around 0.1 to 8 ppm. The concentration of Al obtained by ICP-MS was lower than that obtained by INAA in all samples.

3P12 : Radiochemical study of photospallation at intermediate energies.

Matsumura, H., Yamashita, M.[1], Haba, H.[2], Terada, Y.[1], Washiyama, K.[3], Kikunaga, H.[1], Oura, Y.[4], Miyamoto, Y.[2], Sakamoto, K.[1], Fujiwara, I.[5], Shibata, S.[6], Furukawa, M.[7] (Coll. of Humanities and Sci., Nihon Univ., Graduate School of Natural Sci. and Technol., Kanazawa Univ.[1], Japan Atomic Energy Res. Inst.[2], Fac. of Medicine, Kanazawa Univ.[3], Graduate School of Sci., Tokyo Metropolitan Univ.[4], Fac. of Economics, Otemon-Gakuin Univ.[5], Res. Reactor Inst., Kyoto Univ.[6], Fac. of Environmental and Information Sci., Yokkaichi Univ.[7])

Recently, it became possible to calculate photospallation yields with bremsstrahlung with maximum end-point energy (E_0) higher than 400 MeV by using PICA95 code modified PICA code (Photon-Induced Intranuclear Cascade Analysis Code). Results by the initial PICA code do not reproduce experimental photospallation yields on targets heaver then ^{133}Cs. The newest code, PICA98 code, includes giant resonance of photon absorption, medium effect between nucleons in nuclear, fission, and so on. It is very interesting to compare the calculated results by PICA98 code with experimental yield data. Therefore, we report the comparisons between the calculated yields and the experimental ones that accumulated by radiochemical method in our group at E_0 up to 1200 MeV with 1.3 GeV electron synchrotron of the High Energy Accelerator Research Organization (KEK) at Tanashi. The discussion is concerned with various targets over the periodic table and various E_0.

3P13 : α-source preparation method for on-line aqueous chemistry

Hirai, T., Kaneko, T., Kaji, D., Kudo, H. (Fac. of Sci., Niigata Univ.)

The identification and determination of heavy- and trans-actinoide elements are primarily made by α-ray spectrometry. For α-ray measurements, it is necessary to prepare thin and uniform sources and to carry out under vacuum. Nowadays, an α-source preparation after chemical separation is dropping of liquid sample on a metal foil and followed by evaporation to dryness, but it is not suited for automated system. In this work, as a basic study for on-line chemical separation, source preparation and measurements, we attempted to spray and dry liquid sample in vacuum.

3P14 : Ion exchange behavior of Rf and the homologues - On the tracer experiments -

Toyoshima, A., Shoji, Y., Yokoyama, A., Shinohara, A., Haba, H.[1], Tsukada, K.[1], Nagame, Y.[1]
(Graduate School of Sci., Osaka Univ., Advanced Sci. Res. Center, Japan Atomic Energy Res. Inst.[1])

It is essential for studying the influence of the relativistic effect on the electronic state of Element 104 (Rf) to compare the chemical property of Rf with that of the homologues (Zr and Hf) and the pseudo-homologues (Th). We prepared the radioactive tracers of the homologues, and obtained the distribution coefficients (Kd) in several systems of ion exchange for the homologues to investigate the ion exchange behavior of Rf.

3P15 : Microwave assisted extraction of water from environmental samples for radioactivity monitoring.

Yamaguchi, Y., Saito, T. (Radioisotope Res. Center, Osaka Univ.)

For radiological environmental monitoring, samples such as plants, soil, rainwater and atmospheric gas are radioassayed. Tritium measurements are carried out mainly by using water samples. In environmental samples other than water, water is extracted and distilled before tritium concentration is measured. In the past years, we have been measuring concentration of the free water extracted from pine needle. To conduct environmental radioactivity measurements in a wide scale, sample preparation procedures are required to be simple, reliable, and inexpensive, it did not allow fast treatment. To overcome this limitation, we have developed a new sample treatment method based on microwave heating distillation for environmental tritium monitoring. Our apparatus can simultaneously handle three pine needle samples or five soil samples from different locations. This method is also suited for environmental monitoring during emergency situations because of its capability to treat samples quickly.

3P16 : Radioactivity content of papers (II).

Kobashi, A. (Graduate School of Sci., Univ. of Tokyo)

The radioactivities of naturally occurring radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, and ^{40}K) and a fallout nuclide (^{137}Cs) in magazines and other paper products produced in Japan between 1999 and 2000 were measured by gamma-ray spectrometry to obtain information on radioactivity level of papers. The respective concentration ranges of ^{226}Ra, ^{228}Ra, ^{228}Th, ^{40}K, and ^{137}Cs are 0.4-9.1, 0.1-35.3, 0.1-36.7, 2-26,and 0-2.2 Bq kg^{-1}. The average natural radioactivity contents of paperbacks and magazines made up of color pages were higher than those of printing papers and notebooks. The average ^{137}Cs concentration in common weekly magazines was much higher than those of other paper products.

3P17 : Simulation of Ra-224/Ra-228 activity ratio in Peitou hot spring water.

Kusano, Y., Momoshima, N., Sugihara, S.[1], Huang, C. W.[2], Wu, C. W.[3] (Fac. of Sci., Kumamoto Univ., Graduate School of Sci., Kyushu Univ.[1], Chung Yuan Christian Univ.[2], Taiwan Univ.[3])

The Ra-224/Ra-228 activity ratio at Peitou hot spring water is far-exceeded unity, more than 6, that is unusual because Ra-224 and Ra-228 belongs to thorium decay series. Peitou hot spring produces rare radioactive rock, hokutolite. Hokutolite contains Ra-228 and its daughter nuclides. Recoil of Ra-224 in mineral can increase Ra-224/Ra-228 activity ratio in a leaching solution by preferential dissolution of Ra-224. An experience of extra alpha decay in Ra-224 compared to Ra-228 gives weak binding energy in mineral. We explained the observed high Ra-224/Ra-228 activity ratio at Peitou by a simulation model that hokutolite precipitates from hot spring water at underground waterway. Influential parameters for Ra-224/Ra-228 activity ratio are precipitation rate of Ra-228 from hot spring water, dissolution rate of Ra-224 from hokutolite, and thickness of hokutolite supplying Ra-224 to hot spring water. Even if each of them increases, the Ra-224/Ra-228 activity ratio increases. This simulation model can explain the high Ra-224/Ra-228 activity ratio at Peitou hot spring.

3P18 : Retrospective dosimetry using luminescence by blue stimulation from quartz at JCO

Hong, D. G., Hashimoto, T. (Fac. of Sci., Niigata Univ.)

Single aliquot additive dose method and single aliquot regeneration added dose (SARA) protocol, originally used for dating analysis, are applied to estimate the retrospective dose using luminescence by blue stimulation from unheated quartz collected in the accident site, JCO at Tokai, Japan. The results obtained using the both methods were 72±14mGy and 76±11mGy respectively. They were consistent with the values determined using thermoluminescence (TL) with the various samples collected in a similar site.

3P19 : Radon-222 and Lead-210 collection system utilizing silicone oil as a solvent.

Hirose, N., Tsuyuzaki, N., Yamamoto, H., Mitsugashira, T.[1], Hara M.[1] (Iwaki Electronics Co., Ltd., Oarai-branch, IMR, Tohoku Univ.[1])

The random nature of observed time intervals of alpha-counting (about 5 cps) is applied to develop a random number and the probability generator. A natural radioactive isotope Pb-210, which is a precursor of ^{210}Po seems to be suitable as the alpha-source mounted in a random number generator for an industrial application. In order to collect ^{210}Pb actively from the atmosphere, a scrubber type collection equipment for atmospheric radon was constructed using silicone oil as the solvent for radon. Preliminary testing data for the radon collection is reported as well as the extraction method of Pb-210 in the underground water.

3P20 : Characterization of radioactive aerosols formed in air of a high-energy proton accelerator tunnel (III)

Oki, Y., Endo, A.[1], Kanda, Y., Kondo, K. (Radiation Sci. Center, High Energy Accelerator Res. Organization (KEK), Dep. of Health Physics, Japan Atomic Energy Res. Inst.[1])

Various radionuclides and dense non-radioactive aerosols are produced in the air of high-energy proton accelerator tunnels. Under such a condition, the produced radioactive atoms easily form radioactive aerosols. In this work, focusing on typical radionuclides produced in the tunnel air, such as C-11, Be-7 and Na-24, their aerosol size distributions are reported. The sample air was irradiated in an irradiation chamber installed on the beam line of the high-energy proton accelerator. The aerosol sizes of the radioactive and non-radioactive aerosols were analyzed for the irradiated air using a diffusion battery system. The aerosol radius was found to be 35 nm for C-11, 40 nm for Be-7, 39 nm for Na-24 and 28 nm for non-radioactive aerosols. The formation mechanism of the radioactive aerosols was discussed.

3P21 : Activation of silver items and coins by JCO criticality accident.

Komura, K., Murata, Y., Muroyama, T., (Low Level Radioactivity Labo., Kanazawa Univ.)

Radionuclides indueced by the JCO criticality accident were measured for silver item and coins collected from Tokai-Mura and Naka-Machi. Measured are ^{110m}Ag produced by ^{109}Ag(n,gamma) ^{110m}Ag reaction in silver items and ^{65}Zn, ^{58}Co and ^{60}Co in Japanese-, US- and Taiwan coins. All samples were measured by extremely low background Ge detector in Ogoya underground laboratory. ^{110m}Ag was detected up to about 400m from the Uranium conversion facility in JCO site, however detection of ^{65}Zn was rather difficult in copper coins collected over 200 m of distance. ^{58}Co induced by (n,p) reaction on ^{58}Ni was detected only in the sample collected from close vicinity. ^{60}Co detected in many coins is considered to be produced not from (n,p) reaction of ^{60}Ni but from cobalt impurity in the coin.

3P22 : Determination of ^{32}P and ^{45}Ca in bone samples taken from the victims exposed to high-dose neutron irradiation at the criticality accident in Tokai-mura

Watanabe, Y., Yukawa, M., Miyamoto, K., Nishimura, Y., Muramatsu, Y., Takeda, H., Kouno, F., Jyoushima, H., Hirama, T., Akashi, M. (National Inst. Radiological Sci.)

At the criticality accident in Tokai-mura on 30 September 1999, two workers were exposed to high-dose neutron irradiation. For the purpose of dose estimation, ^{32}P and ^{45}Ca produced through neutron capture reactions were measured in the bone samples from the victims. In the worker who had received higher neutron exposure and died 83 days after the accident, the activities of ^{32}P and ^{45}Ca varied among the bone samples taken from different parts of the body. There was a high positive correlation in the activities between ^{32}P and ^{45}Ca, and the highest activities of both nuclides were observed in the pelvis and the thighbone. This shows that the worker received especially high dose of neutron irradiation in the central part of the body. In the other worker who died 211 days after the accident, only ^{45}Ca could be detected in the bone samples. In this case, the variation of ^{45}Ca activity was also observed among different bone samples in the body. These results give very useful information for the estimation of the situation just when the workers received the exposure of neutron.

3P23 : Special flow properties of groundwater in a small mountainside area by using radon concentration

Horiuchi, K., Sakata, N.[1], Makamura, T.[1], Kobayashi, M.[1] (School of Social Information Studies, Otsuma Women's Univ., Dep. of Natural Sci., Osaka Kyoiku Univ.[1])

From June in 1998, we have studied seasonal variation of radon concentration in groundwater of the 3 different tyoes of small mountainside area which including a landslide area and a artificial change area. At same time we have analyzed some kinds of chemical elements such as Na^+, K^+, Mg^{2+}, Ca^{2+}, HCO_3^-, Cl^-, NO_3^-, SiO_2 and other elements. In the landslide area's samples gave the characteristic variation in radon and SiO_2 concentrations before and after an earthquake. Difference from the concentrations of those chemical elements would be due to the different aquifers or the permeable waters in this landslide area..

3P24 : Development of environmental tritium monitoring system at Toki site

Shinotsuka, K., Yamanishi, H., Uda, T., Sakuma, Y., Kosaka, N.[1], Tsuji, N.[1] (Safety and Enviromental Res. Center, National Inst. for Fusion Sci., Nippon Kucho Service Co. LTD.[1])

D-D experiment using Large Helical Device (LHD), where deuterium plasma is heated by the incidence of deuterium beam, is planned in our institute. We are establishing the environmental tritium monitoring system around the facilities to observe the effluent tritium level and comprehend the detailed variation of background tritium level in the environment. Atmospheric tritium consist of three different chemical forms, HTO, HT and CH_3T. In this system, these are sequentially collected to the molecular sieve traps as tritiated water, where HT and CH_3T are oxidized by the appropriate catalysts. The water samples recovered from the sieve traps are determined by a liquid scintillation counter for tritium. The systems are to be arranged at a few points in the site, taking into account of the meteorological factors.

3P25 : Cosmogenic radionuclide ^{35}S and sulfate depositions in the Sea of Japan side

Funazu, M., Yamamoto, M., Komura, K., Tokuyama, H.[1], Matsuura, H[1], Igarashi, Y.[2] (Low Level Radioactivity Labo., Kanazawa Univ., Fukui Pref. Environmental Radiation Res. Monitoring Center,[1], Meteorogical Res. Inst.[2])

Deposition of ^{35}S, a cosmogenic radionuclide, in rain water samples at Tatsunoguchi of Ishikawa facing the Sea of Japan, has been measured about every 10 days since 1998, with ^{7}Be, ^{210}Pb and some chemical species, including a major acidic species SO_4^{2-}. Annual deposition of ^{35}S, ^{7}Be, ^{210}Pb and ness-SO_4^{2-} in 1999 were 62.2 Bq/m^2, 5158Bq/m^2 , 864.9 Bq/m^2 and 4.5 g/m^2, respectively. More than half (50-70%) of the total depositions of these elements occur during the periods from late autumn to winter. The ratios of Bq(^{35}S,)/mg(ness-SO_4^{2-}) showed the trend becoming higher in late autumn to winter (1.02+-- 0.50) than in spring and summer (0.65 0.35), depending on the transport from the stratosphere and origin of sulfate ion which originates from at lower altitudes.

3P26 : Analysis of trace amount of uranium in organic soil and organic soil extracts- Examination of chemical separation yield.

Fujikawa, Y., Ikeda, E.[1], Fukui, M. (Res. Reactor Inst. Kyoto Univ., Atomic Energy Inst. Kinki Univ. [1])

Chemical separation yield of actinide elements from soil samples with high organic matter content has been often low compared with that from samples with low organic matter content. We compared chemical yield of uranium (U) from organic-rich Japanese soils and four humic acid samples after subjecting them to three different pretreatment procedures ((1) pulverization only, (2) dry-ashing at 510 °C after pulverization, and (3) 680 kGy gamma-ray irradiation after pulverization) prior to acid digestion. Separation of U was done by U-TEVA resin (Eichrom Ind. Co.). For organic samples, pretreatment procedures governed the yield of U significantly. Chemical separation yield of U was low (6±1 %) for humic acid purchased from Aldrich and that extracted from Humic Andosols (soil classification after FAO/UNESCO, 1998) after dry-ashing at 510 °C. For such samples, gamma-ray irradiation improved the yield of U.

3P27 : Development and implementation of BfS-IAR observation method for ^{85}Kr in air at MRI.

Igarashi, Y., Aoyama, M., Nemoto, K., Miyao, T., Hirose, K., Fushimi, K., Suzuki, M.[1], Yasui, S.[1], Asai, Y.[2], Aoki, I.[2], Yamamoto, S.[3], Fujii, K.[3], Sartorius, H.[4], Weiss, W.[4] (Meteorological Res.Inst., Shimazu Corp.[1], Repic Corp.[2], Kansai Environmental Engineering Center Co., Ltd.[3], Institut fuer Atmosphaerische Radioaktivitaet[4])

The major sources for atmospheric ^{85}Kr are nuclear fuel reprocessing plants. The concentration of ^{85}Kr (~1.3Bq/m^3, at present) is increasing at the rate of approximately 30mBq/m^3/year, because the yearly release rate of ^{85}Kr into atmosphere exceeds the removal rate by radioactive decay. Therefore, it is important to monitor the concentration of atmospheric ^{85}Kr in order to evaluate radiological effect on human health and environment. Furthermore, atmospheric ^{85}Kr is very useful as a tracer for validation of transport models. For these reasons, the Meteorological Research Institute (MRI) developed a ^{85}Kr measuring system based on the Bundesamt fuer Strahlenschutz - Institut fuer Atmosphaerische Radioaktivitaet (BfS-IAR) method for the first time in Japan. Intercomparison indicated that ^{85}Kr concentrations determined by our system were in good agreement with those obtained by BfS-IAR within the error of approximately 4% and the temporal trend of ^{85}Kr concentrations by MRI was also very similar to that obtained by BfS-IAR.

3P28 : Natural radionuclide concentrations in marine organisms on the coast of Miyagi prefecture (2).

Ishikawa, Y., Yoshida, N., Kagaya, H., Hoshino, K. (Environ. Radioact. Res. Inst. Miyagi)

About 50 Bq/kg (wet) of ^{234}Th, a descendant of ^{238}U, was detected in ascidian livers which were collected near the coast of Miyagi Prefecture. It seemed that almost ^{234}Th was intaked directly from sea water or feeds. The radioactivity of ^{234}Th in ascidian livers decayed almost with its half-life (24 d) and the radioactivity in radioactive equilibrium with ^{238}U was about 0.5 Bq/kg (wet). Similar phenomena were observed in other marine organisms and sea weeds.

3P29 : Behavior of uranium series nuclides and study on natural analog.

Kanai, Y. (Geological Survey of Japan)

Radionuclides migration might occur in the groundwaters. Some geological events or phenomenon can be thought in view of natural analog study. For example, (1) uranium concentration in groundwater and spring water, (2) precipitation and solution, (3) uranium deposits, (4) speciation and characterization, (5) weathered deposits, (6) uranium valency. They are many important geochemical subjects.

3P30 : Direct observation of organic molecules adsorbed on the graphitic surface of microporous carbon.

Muramatsu, Y., Ueno, Y.[1] (Japan Atomic Energy Res. Inst., NTT Lifestyle and Environmental Technol. Labo.[1])

The possible configurations of the benzene molecule adsorbed in microporous carbon were analyzed by synchrotron-radiation-excited soft x-ray emission spectroscopy and by analyzing its spectral features using DV-Xα molecular orbital calculations. The distances between the adsorbed molecule and the graphitic surface were estimated to be approximately 0.33 nm in the benzene-adsorbed system. The molecular orientation were also estimated to be almost parallel to the graphitic surface of microporous carbon.

3P31 : Preliminary study of amalgam extracting method for production of multitracer

Shibata, S., Enomoto, S.1, Hirunuma, R.[1] (National Inst. of Radiological Sci., Inst. of Physical and Chemical Res. (RIKEN)[1])

When the amalgamated gold target, irradiated by Riken RRC, was agitated with dilute hydrochloric acid, radioactive nuclear species except noble-metals elements were extracted in the aqueous layer. It was enabled to obtain directly the desired multitracer solution for use.

3P32 : Preparation of lutetium-177m

Izumo, M., Matsuoka, H., Hashimoto, K., Uchida, S.[1] (Japan Atomic Energy Res. Inst., Tokyo Nuclear Service Co.[1])

Lutetium-177 has excellent physical properties as a potential therapeutical radionuclides for the palliative treatment of painful osseous metastases. On the other hand, lutetium-177m is very convenient for the research on the behavior of Lu-177, such as the trace of lutetium in vivo throughout the long term, because of its long half-life (160.1 d). In this study, thus, the separation method of lutetium-177m from the by-products produced by the neutron irradiation of lutetium oxide has been established by cation-exchange column chromatography.

3P33 : Synthesis and HPLC analysis of ^{177,177m}Lu complexes with aminomethylenephosphonate

Hashimoto, K., Chen, D.[1], Matsuoka, H., Sorita, T. (Dep. of Res. Reactor, Japan Atomic Energy Res. Inst., Dep. of Isotope, China Inst. of Atomic Energy[1])

The labeling of aminomethylenephosphonate derivatives (EDTMP, EDBMP and NTMP) with ^{177,177m}Lu was investigated in detail. The dependence of the labeling yield upon the reaction conditions such as the concentrations of the ligand and the carrier, pH, time and temperature was examined. Under the optimum conditions, the labeling yields of all the ^{177,177m}Lu-aminomethylenephosphonate (^{177,177m}Lu-amp) complexes were more than 97 %. Furthermore, the stability of the ^{177,177m}Lu-amp complex in solution and their HPLC behavior (anion exchange and silica gel reversed-phase column chromatography) were also studied.

3P34 : Behaviors of the ^{133}Xe atoms implanted into C_{60} fullerenes

Shimomura, H., Yoshikawa, K., Muramatsu, H., Watanabe, S.[1], Ishioka, N.[1], Osa, A.[1], Koizumi, M.[1], Sekine, T.[1] (Dep. of Chemistry, Fac. of Education, Shinshu Univ., Japan Atomic Energy Res. Inst.[1])

Radioactive ^{133}Xe was implanted into C_{60} fullerene at a terminal voltage of 40 kV by means of an electromagnetic isotope separator. The targets used for ion-implantations were C_{60} fullerene stacks on Ni foil by vacuum evaporation and C_{60} pellets mixed with CsI or CsCl in some compositions. To confirm that ^{133}Xe@C_{60} (a single ^{133}Xe atom trapped inside a C_{60} fullerene cage) was produced or not, the implanted targets were dissolved in o-dichlorobenzene, and a fraction of solution was injected into a HPLC column. The radioactivity of ^{133}Xe was monitored in 1 min intervals by measuring the 81-keV γ-rays. As a result, the radioactive endohedoral fullerene ^{133}Xe@C_{60} was detected using a radiochemical technique combined with chromatography.

3P35 : A multitracer study on the diffusion of various elements in pore water of granite

Egawa, C., Takahashi, Y., Enomoto, S.[1], Hirunuma, R.[1], Shimizu, H. (Graduate School of Sci., Hiroshima Univ., Inst. of Physical and Chemical Res. (RIKEN)[1])

After high-level radioactive waste is disposed in a deep underground repository, radionuclide may be leached from the waste and may subsequently be transported through the surrounding rock by ground water. For evaluating a transport of radionuclide in geosphere, it is important to understand the diffusion of elements in rocks by ground water. In this study, diffusion experiments were conducted using the multitracer technique containing 14 radioisotopes (^{7}Be, ^{48}V, ^{51}Cr, ^{54}Mn, ^{58}Co, ^{59}Fe, ^{65}Zn, ^{74}As, ^{75}Se, ^{83}Rb, ^{85}Sr, ^{88}Y, ^{88}Zr, ^{103}Ru) to discuss the relation between differences of chemical character of various elements and their diffusion behavior. Diffusion pathways were found in biotite, plagioclase and grain boundary by autoradiography. The diffusion model taking account of the adsorption on biotite is under investigation.

3P36 : Solvation number of Tb(III) in a mixed system of methanol and water.

Mabuchi, Y., Watanabe, T.[1], Kawasaki, M., Yanaga, M., Suganuma, H., Satoh, I.[2], Yaita, T.[3], Takai, K.[3], Narita, H.[3], Suzuki, S.[3], Tachimori, S.[3] (Fac. of Sci., Shizuoka Univ., Graduate School of Sci. and Engineering, Shizuoka Univ.[1], Inst. for Materials Res., Tohoku Univ.[2], Japan Atomic Energy Res. Inst.[3])

In aqueous solution, hydration number of Tb^{3+} is 8. When the composition of solvent is varied in a mixed system of CH_3OH and H_2O, the solvation number of Tb^{3+} may vary. We tried to estimate the solvation number in the mixed system by (1) solvent extraction method and (2) EXAFS. (1)By a mean of solvent extraction, though the mole fraction of methanol (X_S) varies in the mixed system, interionic distance of Tb^{3+}-Cl^- did not varied in the mixed system of methanol and water ($0 \leqq X_S \leqq 0.309$). This indicates that methanol molecule do not exist in the primary solvation sphere of Tb^{3+}. (2) EXAFS also revealed that solvation number of Tb^{3+} did not varied in the region of $0 \leqq X_S \leqq 0.989$. Therefore, solvation number of Tb^{3+} do not vary in this mixed solvent system.

3P37 : Mössbauer studies on particle volume distribution of alpha-FeOOH in rust formed on weathering steels

Kobayashi, Y., Okada. T., Ishii, Y.[1], Mizoguchi, T.[1], Tamura, I.[2], Takagi, Y.[3], Kihira, H.[3], Suzuki, S.[3], Ito, M.[3] (RIKEN, Fac. of Sci., Gakushuin Univ.[1], Toyama Medical and Pharmaceutical Univ.[2], Nippon Steel TechnoResearch Co.[3])

Rust formed on weathering steel and that on mild steel were studied by Mössbauer spectroscopy at various temperatures from room temperature to 12 K. Volume distributions of alpha-FeOOH particles by analysing the superparamagnetic relaxation effect on Mössbauer spectra were determined. alpha-FeOOH particles in the rust on weathering steel occurs a continuous and wide volume distribution down to the ultrafine particle region, smaller than 3.0 X 10^{-24} m^3, without missing region. It is understood that this distribution is favourable for accommodating a closely packed structure in the protective rust layer on weathering steel.

3P38 : Vertical distribution of elements and chemical states of iron by Moessbauer spectroscopy in Yatsu Tideland sediment

Kataoka, M., Matsuo, M.[1] (Graduate School of Sci., Univ. of Tokyo, Graduate School of Arts and Sci., Univ. of Tokyo[1])

We collected sediments vertically in Yatsu tideland which is located in Tokyo bay area. Using Instrumental Neutron Activation Analysis and Prompt γ-Ray Analysis, we have got vertical distribution of thirty and more elements. Chemical states of iron in the sediments were investigated by Moessbauer Spectroscopy, indicating that a maximum pyrite distribution was found in the middle layer. This suggests that pyrite, which is one of the iron sulfide, was formed under the reducing conditions with the aid of sulfate-reducing bacteria below the middle layer in the sediments.

3P39 : Oxidation and structural change of azaferrocene derivatives.

Tanaka, M., Nakashima, S.[1], Okuda, T. (Graduate School of Sci., Hiroshima Univ., Radioisotope Center, Hiroshima Univ.[1])

We studied the effect of methyl substituents in the cyclopentadienyl ring on the oxidation state of azaferrocene. We found that the iron atom is oxidized by means of ^{57}Fe Moessbauer spectroscopy. We examined the change of ^{1}H-NMR spectra by adding iodine successively. With increasing the amount of I_2, all signals are found to become broad and then reappeared at down-field positions. Mass spectrum of this iodine salt showed the signal of the binuclear complex.

3P40 : Moessbauer study of ancient iron smelting slag : a modern simulation experiment.

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For the investigation of the ancient iron manufacturing technique, the Committee of Education in Katano City carried out a modern simulation experiment. In this experiment, two smelting furnaces were constructed; iron ore was used as the raw material in one furnace and iron sand in another one. During the operation of the furnaces, a large amount of slags flowed away from them. Moessbauer spectroscopy was applied for characterizing these slags and the furnace wall.

3P41 : ^{155}Gd Moessbauer spectra and crystal structures of some gadolinium(III) complexes with acetylacetone derivatives

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The ^{155}Gd Moessbauer spectra of four Gd(III) beta-diketone complexes are reported. The coordination number for Gd^{3+} ion in $Gd_2(dpm)_6$ is seven, but it is eight in Gd(beta-diketone)$_3$ · $2H_2O$ (beta-diketone =bfa, bza and taa). The differences in their ^{155}Gd isomer shifts are small for these complexes. The larger e^2qQ value in $Gd_2(dpm)_6$ reflects the differences in the coordination number. There is a tendency that the isomer shift value decreases with the increase in the number of the coordinating nitrogen atoms: i.e. beta-diketone complexes (GdO_7 or GdO_8) > EDTA complexes (GdN_2O_6 or GdN_2O_7) > cyano-bridged complexes (GdN_6O_2).

3P42 : DV-Xα calculation and Moessbauer parameters in iron dithiocarbamate complexes

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DV-Xα calculations were carried out for $Fe(dtc)_2X$ complexes (dtc=dithiocarbamate, X=Cl, Br, I, and NO), exhibiting intermediate spin states. The magnetic data for the complexes are explained with the difference of up and down spin numbers occupying Fe 3d orbitals. The quadrupole splittings of Moessbauer spectra for these complexes are compared with the electric field gradient (Vzz) calculated from the DV-Xα method.

3P43 : Synthesis of tritium-labeled 15-deoxy-TIC with high binding affinity and selectivity to prostacyclin receptor in the central nervous system.

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We synthesized tritium-labeled 15-deoxy-TIC with high binding affinity and selectivity to prostacyclin receptor (IP2) in the central nervous system. The binding sites of this ligand in the central nervous system was investigated by in vitro autoradiography.

3P44 : The reaction of Re-186 and penicillamine

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It was confirmed that the Re-186-penicillamine polynuclear complex could be synthesized under the moderate condition. This convenient synthesis method will be readily used in the treatment field.

3P45 : Performance of accelerator mass spectrometer in JNC tono geoscience center

Hama, K., Xu, S., Iwatsuki, T. (JNC TGC)

A Tandem Accelerator mass spectrometer, an apparatus dedicated to high sensitivity ^{14}C measurements, manufactured by NEC, USA, has been used since 1996 to measure the ^{14}C concentrations of environmental samples as well as ^{14}C dates of geological and archaeological materials, at JNC Tono Geoscience Center. The authors present here a brief review of the present performance and the future plan.

3P46 : Concentration of ^{14}C and carbon isotope composition in food

Sakamoto, N., Arima, T., Inagaki, Y., Idemitsu, K., Furuya, H., Kawamura, H.[1], Matsuoka, N.[1], Tawaki, S.[2] (Graduate School of Technol. Kyushu Univ., KEEA[1], Kyushu Electric Power Co., Ltd.[2])

Because of recent progress of organic chemical compound technique, synthetic products derived petrochemical compounds are used as alternate sources for natural products. They can be synthesized inexpensively from fossil fuel and in sufficient purity to be indistinguishable from their naturally grown counterparts. Our research distinguished between natural product and synthetic product by measurement of concentration ^{14}C and between C3-plant and C4-plant of materials for foods by measurement of $\delta^{13}C$.

3P47 : Comparison of hydroxyl radical scavenging activity by the solid and liquid state spin trapping methods

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ESR spin trapping method was used to measure OH radical scavenging activity of antioxidants. Conventional method used a Fenton reaction as a OH radical generating system, but we proposed two methods by using gamma-irradiation. One uses high dose-rate and short-time irradiation at room temperature and the other uses low dose-rate and long-time irradiation at 195 K. The reaction temperatures are different on two methods, so different results might be obtained. Therefore, we compared the scavenging activity of four tea catechins by using these methods.

3P48 : Thermoluminescence from oxide formed on silicon wafer.

Tsuboi, T., Hashimoto, T. (Fac. of Sci., Niigata Univ.)

Thermoluminescence was investigated for the oxide formed on silicon wafer. No thermoluminescence was observed from the thermally grown oxide; whereas the NaOH-deposition prior to the thermal treatment permitted the detectable blue thermoluminescence. The thermoluminescence spectra was measured. The peak was observed at 410 nm in wavelength and at 400 K in temperature.

3P49 : Establishment of the highly precise separation method for multi nuclides activity measurement with the NaI(Tl) scintillation counter

Goto, T., Kawai, K.[1], Tahara, Y.[2] (Div. of Radioisotopes, Miyazaki Medical Coll., Central Res. Lab., Miyazaki Medical Coll.[1], Dep. of Radiology, Miyazaki Medical Coll.[2])

The environmental monitoring of hot laboratories is essential to radiation protection for workers and the public. However, determination of nuclides and quantitative analysis of the radioactivity for environmental monitoring are not easy because the radioactivity is very small amount, and besides, several nuclides exist there. We studied the highly precise separation method for multi nuclides activity measurement with the widely applicable NaI(Tl) scintillation counter for application to the environmental monitoring method.

3P50 : Synthesis of mixed valence iron(II, III) complexes with photoisomerizable ligand.

Ohto, S., Suenaga, M., Maeda, Y. (Graduate school of Sci., Kyushu Univ.)

The electronic spin-state transition of $[Fe^{II}Fe^{III}L^1(pazo)](pazo)(PF_6)_2$ may be triggered through *cis/trans* photoisomerization of the ligands, where HL^1 is 2,6-bis[N-(2-pyridylmethylidene)-aminoethyl-N-(2-pyridylmethyl)- amonomethyl] -4-methylphenol and Hpazo 4-phenylazobenzoic acid. The ^{57}Fe Mossbauer and variable-temperature magnetic susceptibility data for the complexes show that the irons(II) are in high-spin state and irons(III) in low-spin state. The data of the UV-visible spectra show that the complexes do not exhibit spin-equilibrium in acetonitrile solution. When the complexes in acetonitrile are irradiated with light of l=313nm, the spectral change attributed to *trans* →*cis* photoisomerization of azo group is observed, but no change in the charge transfer bands is observed. Similarly, the change in the reflection spectra of the complexes irradiated with light of l=313nm is attributed to *trans*→*cis* photoisomerization.