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E-mail jnrs.editor@radiochem.org

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Hisaaki Kudo *Department of Chemistry, Faculty of Science, Niigata University, Niigata 950-2181, Japan*

E-mail hkudo@sc.niigata-u.ac.jp
Fax +81-25-262-6171

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E-mail office@radiochem.org
Fax +81-29-282-6723

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SPECIAL ISSUE
of
The Fourth International Symposium on Advanced Science Research

Advances in Heavy Elements Microbiology (ASR2004)

November 15 and 16, 2004
Tokai, Ibaraki, JAPAN

Guest Editors
Arokiasamy J. Francis (*BNL*)
Yoshitomo Watanabe (*CRIEPI*)
Toshiyuki Yamashita (*JAERI*)
Toshihiko Ohnuki (*JAERI*)

Organized by Advanced Science Research Center, Japan Atomic Energy Research Institute
Co-Organized by Central Research Institute of Electric Power Industry

Supported by Japan Society of Nuclear and Radiochemical Sciences, and Division of Nuclear Fuel Cycle and Environment, Atomic Energy Society of Japan

Preface

The Fourth International Symposium on Advanced Science Research focused on Advances in Heavy Elements Microbiology Research (ASR2004). It was held on November 15 and 16, 2004 at the Advanced Science Research Center (ASRC), Japan Atomic Energy Research Institute (JAERI), Tokai, Ibaraki, Japan. ASRC of JAERI, Tokai, Japan in cooperation with the Central Research Institute of Electric Power Industry, Tokyo, Japan graciously organized the symposium.

Contamination of the environment due to the nuclear-fuel cycle and defense-related activities is a major concern for many countries. Undoubtedly, actinides are here to stay, and it is important that we have a better understanding of their behavior in the environment, in particular, how microorganisms affect their stability and mobility. While there is considerable understanding of the physics and chemistry of the actinides, little yet is known of microbiological effects on them. Actinide microbiology is an emerging scientific field that may be expected to grow rapidly in future.

I believe that this is the first conference of its kind in Japan dealing with the interactions of microorganisms with heavy elements. As we are aware, for obvious reasons, there is considerable interest in Japan and in other countries on microbial processes and their effects on heavy elements. This symposium provided a timely forum for scientists and students in Japan working in this field to exchange information with national and international colleagues. JAERI served as an excellent focal point to coordinate the discussions of recent progress in this research; perhaps we may look forward to their organizing future meetings to debate the latest developments in this field.

The symposium examined the state-of-the-art developments and innovations in the environmental chemistry and microbiology of heavy elements. The sessions, both oral and poster presentations, focused mainly on topics such as the interactions of heavy elements with microorganisms, particularly emphasizing lanthanides and actinides, on environmental chemistry, nuclear-waste disposal, remediation science, biotechnology, and soil microbiology. Other themes covered the mechanisms of biosorption and biotransformation, radiation effects, the development of novel analytical methods to determine the speciation of heavy elements, microbiological effects on the migration of heavy elements, and modeling of microbial processes. Invited speakers from Canada, the United Kingdom, Sweden, the United States, and Japan, who are known worldwide as leading authorities in the field, delivered the Keynote Presentations.

The papers published in this volume represent a snapshot of the various topics discussed at the symposium. In my view, this is an excellent start, and I sincerely hope that future symposia will not only continue to cover advances in these areas, but also extend into other subjects of importance to this burgeoning field. Fundamental information on the biotransformation of actinides under different microbial processes and conditions will be vital in developing appropriate strategies for remediation and waste management, as well as for definitively predicting microbial impacts on the long-term performance of waste repositories.

I would like to express sincere gratitude to Dr. Toshihiko Ohnuki, Secretary of the Symposium, for organizing this meeting, and for the many long hours of work he contributed to ensuring its great success. I extend my thanks to Dr. Hiroshi Yasuoka, Director, ASRC for his continued interest, enthusiasm, and support that made this symposium possible. I also want to take this opportunity to acknowledge the inspiration and encouragement that Dr. Zenko Yoshida, Deputy Director General, Tokai Research Establishment, at JAERI, invariably has offered in promoting Actinide Environmental and Chemistry and Microbiology research at JAERI. We thank Dr. Avril Woodhead, Senior Editor, Brookhaven National Laboratory for the editorial assistance.

Finally, on behalf of all participants, I highly commend the local organizing committee, Drs. Takuo Ozaki, Fuminori Sakamoto, Naofumi Kozai, and Issay Narumi, who were dedicated and tireless in making sure that the attendees were well looked after and conference ran on smoothly.

Arokiasamy J. Francis
Chairman of the symposium
Microbiologist/Scientist
Brookhaven National Laboratory
Upton New York 11973
USA

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Welcome address

Good morning, Ladies and Gentlemen.

My name is Hiroshi Yasuoka, and I am the Director of Advanced Science Research Center. It is great honor to have the opportunity to say a few words before opening the symposium. First, on behalf of all the members of the Advanced Science Research Center of Japan Atomic Energy Research Institute, I would like to express our great pleasure in welcoming every one of you, and in hosting the Fourth International Symposium on Advanced Science Research, namely ASR2004.

Our center was established in 1993. Since then, one of its most important functions as a scientific center has been to promote and initiate basic research in atomic energy and related fields, in collaboration with scientists throughout our country as well as abroad.

In view of the rapidly advancing frontiers of science and technology, and the increasing importance of international collaborations, I strongly felt that our center should play a leading role in furthering scientific activities within a worldwide forum. This approach not only is intended to foster the "give-and-take" exchange of information with the outside world, but also designed to encourage harmony between different scientific cultures though the establishment of our new program at our center.

As one action towards the global promotion of our research activities, we decided to host a series of international symposia on advances in various topics in fields of our interest. We call this the "Advance Series of Symposia". The first such symposium, on neutron scattering, was held in November 2000. The second symposium, held in November 2001, focused on heavy element research. We held the third in November 2002 on the physics and chemistry of the f-electron system. So far, all of them have been very successful and informative, fully meeting our goals. The present symposium is the fourth of this series. The size and format of each symposium is flexible, with choices made considering the nature of the topic. However, at all symposia , in addition to promoting the exchange of expertise, we particularly encourage young scientists to present papers on their new results from the frontiers of science and technology, so that we can help them to gain t an overview of the fields they are involved in.

The topic of the present symposium is Advances in heavy elements microbiology research. I will not go into details about the importance of this field because the Chairman of the Organizing Committee, Dr. A. J. Francis, will speak about these later. Nevertheless, let me emphasize that the main scientific topics to be discussed at this symposium, namely, the interactions of heavy elements and microorganisms are quite fascinating, especially those relating to the mobility and stability of actinides in the environment. I expect that there will be a variety of heated discussions throughout this symposium.

Finally, I would like to thank our president, Mr. Okazaki for his financial sponsorship that has allowed us to convene this meeting. My special gratitude also goes also to the Central Research Institute of Electric Power Industry, Japan Society of Nuclear and Radiochemical Science, and Division of Nuclear Fuel Cycle and Environment, Atomic Energy Society of Japan for their gracious endorsement.

I would like to close my welcome by expressing my sincere wishes for the success of the symposium, and my hope that all participants will discover exciting new opportunities in the still-growing area of research on heavy elements microbiology.

Thank you very much for your attention.

Hiroshi Yasuoka
Director, ASRC, JAERI

Welcome address

Good morning Ladies and Gentlemen.

Welcome to 'The Fourth International Symposium on Advanced Science Research – Advances in Heavy Elements Microbiology Research (ASR2004)'. On behalf of Central Research Institute of Electric Power Industry (CRIEPI), I express my gratitude for all the participants of this symposium. The relationships between the heavy elements and microorganisms have been of technical interest. Especially, behavior of the heavy elements in the environment has recently been important in terms of the safety assessment of the waste management. CRIEPI has been interested in this scientific and technologically important field, and very grateful to support ASR2004.

Since the symposium program covers most of interdisciplinary research areas, I hope all participants exchange the latest results and enjoy discussion. Also, as it is very beautiful season, please enjoy Japanese autumn.

Motoi Kawanishi
Director, NFCBRC, CERL, CRIEPI

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