

## Preface

Owing to the fast economic growing and the concern over greenhouse gases and air pollution, the development of nuclear energy is one important option to meet the expanded energy consumption in our future. To achieve that goal, continuing and reliable supplies of uranium are critical to future nuclear power projects. As is well known, global terrestrial reserves of uranium are limited and the deposits in China are relatively small. Given the projected big growth in nuclear power in the future, reliable supply of uranium at a reasonable price is essential for China. Extraction of uranium from seawater faces a great challenge but has received attention for more than sixty years. It is described by American scientists recently as a “game-changing” approach if it can be realized at economic viable costs. Encouraged by the global aggressive nuclear power development plans in the past years, although the pace was slow down by Fukushima accident in Japan in 2011, extraction of uranium from seawater has been emerging as a potential approach to overcome the shortage of nuclear fuel.

Japan is playing a leading role in the research of uranium extraction from seawater; it has collected more than one kilogram of uranium from seawater by immersing functionalized polyethylene fibers in ocean. The United States Department of Energy (DOE) supported a program in 2010 to start a project for uranium extraction from seawater, some universities and institutions have been engaged in such project. Almost at the same time, a project was supported by the Chinese Academy of Sciences (CAS), although in a small budget, to evaluate the feasibility of extracting uranium from seawater and salt lake. This could be considered as a new era for the research on uranium extraction from seawater in China. CAS and DOE have now established a tight collaboration mechanism for uranium extraction from seawater.

Besides some institutions of CAS, many research groups in universities and institutions of China have also shown great interests or already joined the work on uranium extraction from seawater. Since uranium is present in very low concentrations in ocean (3.3–3.5 ppb), the collection of uranium from seawater economically is far more difficult than any usual collection process of metal ion from aqueous so-

lution. Therefore, many approaches should be taken to design and synthesize functional ligands, develop advanced sorbents, understand the coordination mechanism, and find suitable elution process. To make the extraction of uranium from seawater more economically competitive, mass production of high performance adsorbents at a reasonable cost and good durability of adsorbent in seawater are two most important issues.

In March 25–26, 2013, the workshop on extraction of uranium from seawater was held in Shanghai, with more than eighty attendees from China and five delegates from the US. This workshop was initiated by Prof. Zhifang Chai at Institute of High Energy Physics of CAS, and financially supported by the National Natural Science Foundation of China, Shanghai Institute of Applied Physics (CAS), and China Academy of Engineering Physics. There were four invited talks and twelve oral presentations. The numbers of attendees and presentations are much higher than expected. The topics presented at the workshop cover a wide range of areas, including computer modeling, synthesis of nanoparticle with large surface area, radiation induced grafting of polymer fiber and following amidoximation, sorption and elution processes, marine test, etc. This workshop could be considered as the first one on the topic of uranium extraction from seawater in recent twenty years in China.

After the workshop, the organizing committee invited five research groups to make contributions and decided to publish them in a special mini-issue in *Science China Chemistry*. These five excellent contributions show us the ongoing of project in different approaches. We appreciate very much the contributors for their great efforts.

Finally, we sincerely hope more scientists will be engaged in uranium extraction from seawater and the dream of uranium supply from ocean for nuclear energy will come true in next decades.

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September 10, 2013



**Prof. CHAI ZhiFang** is a radiochemist working at Institute of High Energy Physics, Chinese Academy of Sciences, and Suzhou University. He was graduated from Fudan University, China, in 1964. As a fellowship of the Alexander von Humboldt Foundation, Germany, he worked at Cologne University from 1980 to 1982. He is closely engaged in nuclear energy chemistry and nuclear analytical techniques, and has authored or co-authored over 500 papers in peer-review journals and 10 books. He is/was a titular member of IUPAC, fellow of RSC, UK, and member of many other domestic and international scientific communities. He is an editor or advisor of 4 international and 10 national journals. In 2005, he was awarded the George von Hevesy Award – the premier international award of excellence to honor outstanding achievements in radioanalytical and nuclear chemistry. In 2007, he was elected as a member of the Chinese Academy of Sciences.



**Prof. WU GuoZhong** is a group leader at Shanghai Institute of Applied Physics, Chinese Academy of Sciences. He received his B.S. degree in 1992 from University of Science and Technology of China (USTC) and Ph.D in 1998 from the University of Toykyo, Japan, and returned to China in 2002. He has been working in the field of radiation chemistry and radiation processing for about 20 years. His major research interests include uranium extraction from seawater using radiation functionalised polyethylene fiber, radiation crosslinking and degradation of polymers and application, and radiation induced chemical reaction kinetics.