Role of inorganic chemistry on nuclear energy examined

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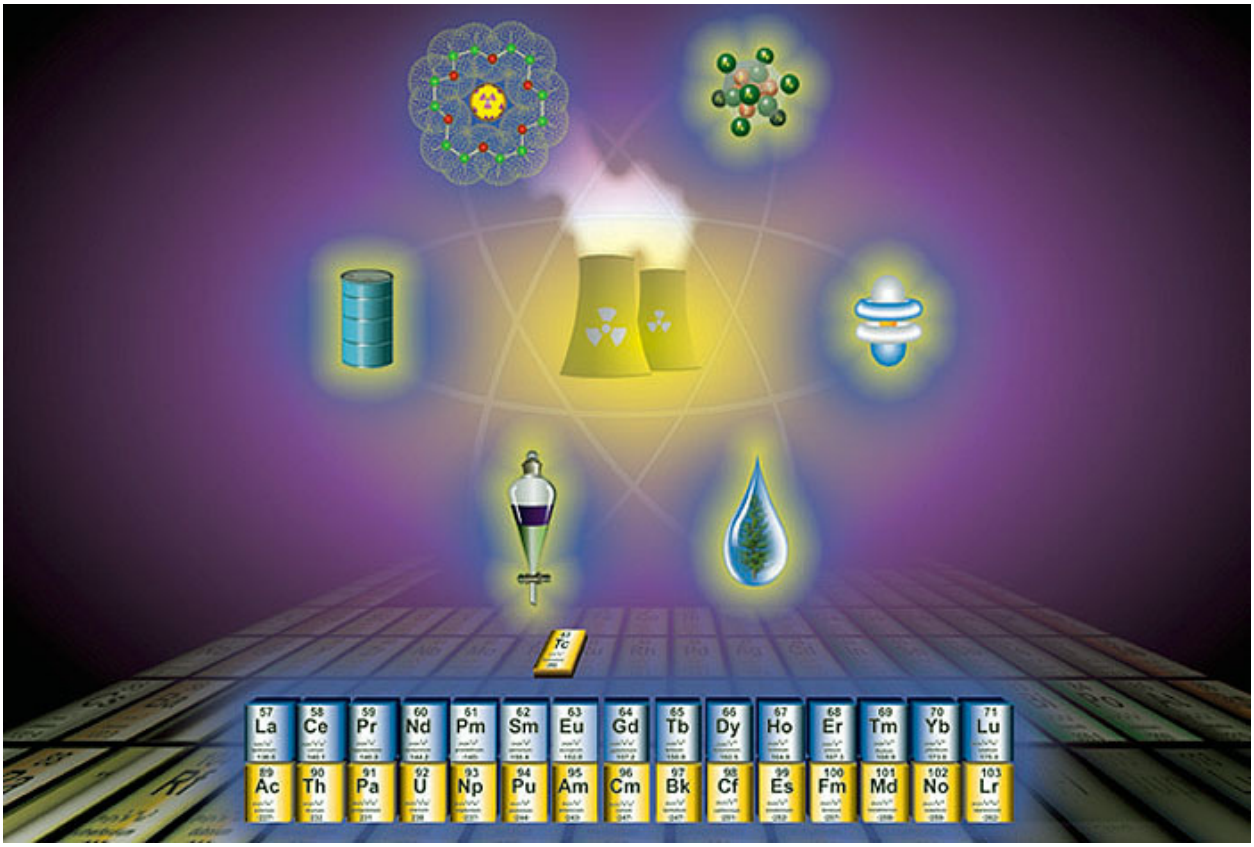

The journal *Inorganic Chemistry* published a special Forum issue on the role of inorganic chemistry in nuclear energy. John Gordon of LANL's Inorganic, Isotope and Actinide Chemistry group guest edited the issue. Gordon, a member of the journal's editorial advisory board, was invited to participate in this capacity due to the Laboratory's seminal role in the field of inorganic actinide chemistry. The Forum contained invited contributions from distinguished scientists, some from Los Alamos, who presented fundamental as well as application-driven research.

Significance of the research

The efficacy of nuclear power production rests on the ability to manage a nuclear fuel cycle safely, efficiently, and economically. "Fuel cycle" is the term used to describe how nuclear fuel progresses through the various stages involved in generating electricity. A particular type of fuel cycle comprises steps in the "front end," which represent the preparation of the fuel (e.g. mining and fuel enrichment); the "service period" when

the fuel material is used in reactor operation for electricity production; and the “back-end” steps, which are aimed toward the safe handling and subsequent reprocessing or disposition of spent nuclear fuel materials. The articles in the issue discussed inorganic chemistry as it relates to different aspects of the fuel cycle. Inorganic chemistry can provide insight and improve technical issues surrounding nuclear power production and waste disposition.

Research achievements

Alkaline radioactive wastes exist in many countries. Knowledge of the nature of chemical species formed under these conditions is a prerequisite to remediation of these legacy wastes. Under the strongly alkaline conditions characteristic of waste tanks and sludge washing conditions, transuranic elements can dissolve, causing difficulty in separations and partitioning into both high- and low-level waste components. One paper presented the results of spectroscopic techniques that probed the nature of neptunium chemistry under the highly alkaline conditions that are relevant to alkaline radioactive waste forms.

The fission of actinides in reactors produces the lightest radioelement, technetium. An understanding of the chemistry of technetium and the ability to manipulate its chemistry could be exploited in the fuel cycle for waste forms and in separation technologies. A paper reported the synthesis of new technetium halides and demonstrated trends with structure, coordination number, and speciation that can be used in the nuclear fuel cycle. The authors provided examples of technetium-zirconium alloys as waste forms.

The research team

Los Alamos researchers include David L. Clark, Steven D. Conradson, Robert J. Donohoe, John C. Gordon, Pamela L. Gordon, Gordon D. Jarvinen, D. Webster Keogh, Phillip D. Palmer, Brian L. Scott, and C. Drew Tait. Scientists from Hunter College (City University of New York), University of Nevada–Las Vegas and Argonne National Laboratory collaborated on the work.

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