ACTINIDE MATERIALS FOR SUPERHEAVY ELEMENT RESEARCH

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The first superheavy element, rutherfordium (element 104), was discovered at the Joint Institute for Nuclear Research (JINR) in Dubna in 1964 by bombarding an actinide target (^{242}Pu) with neon ions. Since then, 14 additional superheavy elements through oganesson (element 118) have been discovered, completing the seventh row of the periodic table. Of the 15 total superheavy elements to date, eight were discovered using actinide targets. Ongoing efforts to synthesize elements 119 and 120 are also using actinide targets.

The use of heavy actinides as targets in "hot fusion" reactions with ^{48}Ca ion beams has enabled a significant expansion of the nuclear chart (five new elements and more than 50 new heaviest isotopes since 2000)[1]. These experiments have utilized actinide targets from specialized facilities at Oak Ridge National Laboratory (ORNL) and the Research Institute of Advanced Reactors at Dmitrovgrad. These facilities, including the High Flux Isotope Reactor and Radiochemical Engineering Development Center at ORNL[2], provide unique capabilities to produce, separate, and purify rare actinide materials, and fabricate actinide targets.

Continued progress in superheavy element research is limited by the ability to produce significant quantities of actinides heavier than californium and by lower production cross sections for the heavier ion beams required to reach beyond oganesson using existing target materials. This points to the need for new actinide production methods and more intense ion beams. New, more powerful accelerator facilities have been developed at JINR and at RIKEN in Japan to expand research on superheavy nuclei, including the search for new elements 119 and 120. These facilities will require increased quantities of actinide target materials. This paper will review the role of actinide materials in advancing superheavy element research, as well as opportunities to enhance the production and performance of actinide target materials for the synthesis of superheavy nuclei.

References
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