

# Materials Science & Engineering and Metallurgical Engineering Graduate Seminar

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### Prospects for Use of Molten Salts in Advanced Nuclear Energy Systems

Much of the nuclear energy research sector is currently looking to the next generation of reactors and fuel cycle systems to enable sustainable, safe, secure, and economical generation of nuclear power for many generations into the future. One of the key transformations that should be anticipated is the phasing out of water as the key fluid in power reactors and waste processing. The initial choice of water for these applications starting in the 1950s was certainly sensible given its availability, cost, and ease of handling. But most of the notable nuclear accidents that have occurred in this first generation of nuclear power have been caused when reactors have lost cooling water. And some of the deadliest nuclear fuel reprocessing accidents have been caused by water-inducing criticality. Molten salts can be an effective and safe replacement for water in each of these nuclear applications. This seminar will explain the potential application of molten salts in nuclear reactors as either primary coolants or actual fuel and review the current state of the technology. Progress made by companies such as Bill Gates' TerraPower will be discussed objectively for understanding their potential for revolutionizing commercial power generation. The nuclear fuel cycle will also be discussed with focus on the reprocessing technology that can extract useful elements from nuclear waste and use them in making new fuel. Commercial nuclear fuel cycle facilities use water-based extraction processes. But recent advances in molten salt based pyroprocessing are causing the gap in technology maturity to be rapidly diminished. Molten salts are, thus, becoming one of the most important materials to study and understand as the nuclear energy industry transforms to gain long term global relevance.

