**─Abstract─**

# Molten Salt Reactors: Options and Missions

Charles W. Forsberg
Oak Ridge National Laboratory*
P.O. Box 2008
Oak Ridge, TN 37831-6165
Tel: (865) 574-6783
Fax: (865) 574-0382
E-mail: **forsbergcw@ornl.gov**

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Oak Ridge National Laboratory
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Many molten fluoride salts are highly stable in radiation fields, have excellent heat transfer properties, can dissolve high concentrations of actinides and fission products, and have very low vapor pressures with boiling points in excess of 1400ºC. As a consequence, such salts are being considered for four nuclear applications. These applications will be examined, with the primary emphasis on the Molten Salt Reactor (MSR) and the Advanced High-Temperature Reactor (AHTR).

The MSR is a fluid reactor in which uranium and other actinides are dissolved in a molten fuel salt. The salt flows through a reactor core of graphite, where the graphite acts as a moderator and fission occurs within the molten salt. The molten fuel salt transfers its heat to a secondary molten-salt heat-transport system that, in turn, transfers the heat to the power cycle. Because the MSR has a liquid fuel, the reactor has the unique safety advantage of dumping the fuel salt to critically safe, passively cooled storage tanks in the event of an accident. The fuel salt can be processed on-line, a capability that enables the MSR to be a thermal-neutron breeder reactor and have very different fuel cycles. Two experimental MSRs have been built.

The AHTR uses solid graphite-matrix coated-particle fuel (similar to that used in gas-cooled reactors) and a clean molten salt coolant. The molten salt coolant transfers its heat to a secondary molten-salt heat-transport system that, in turn, transfers the heat to a power cycle or hydrogen production plant. The AHTR is a new concept with the potential to operate at very high temperatures (1000ºC) as a passively-safe large reactor.

Molten-salt heat-transport systems are being considered to move heat from the AHTR or gas-cooled reactors to thermochemical hydrogen production plants. Last, the fusion energy community is considering molten salts to cool fusion reactors and breed tritium.