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MSRs – LeBlanc
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MSRs have a 2 loop system where fissile UF4 salt is mixed with fertile ThF4 salt in an upwards combined concentration of 14% in FLiBe salt solvent. The surrounding elements have to be corrosion resistant nickel based alloys that can operate in high temperatures. The advantage to having a liquid fuel is that it eliminates the possibility of a reactor meltdown which increases the safety of the system. Some designs of MSRs employ a two fluid design where the fissile fuel runs over a blanket of fertile fuel and upon transmutation into fissile material is fluorinated into the liquid salt. This method makes it easier to process out fission products because there is no Thorium in the liquid, and thus no intermediate Pa that must be left in the salt during the filter process.

The Oak Ridge National Lab did not spend much time attempting to optimize the design of their DMSR converter. Their converter was meant to last for 30 years during operation and had no special details. The converter designs now are attempting to largely improve the functionality of the ORNL design to allow a higher conversion ratio. Some simple improvements are just increasing the percentage of fuel in the molten salt which other proposals include using a pebble bed of graphite.

Overall this paper goes through the history of MSRs and how superior they could be to LWRs if implemented correctly. One topic that is not discussed in this paper is the decommissioning aspect being significantly more complicated for an MSR. Since the fuel is in the salt then it becomes necessary to treat all of the primary loop as TRU or HLW contaminated, including the structures. This may increase costs to where the benefits of MSRs cannot offset the financial burden.