GEN IV International Forum℠
Expertise | Collaboration | Excellence

Concept of European Molten Salt Fast Reactor (MSFR)

Summary / Objectives:

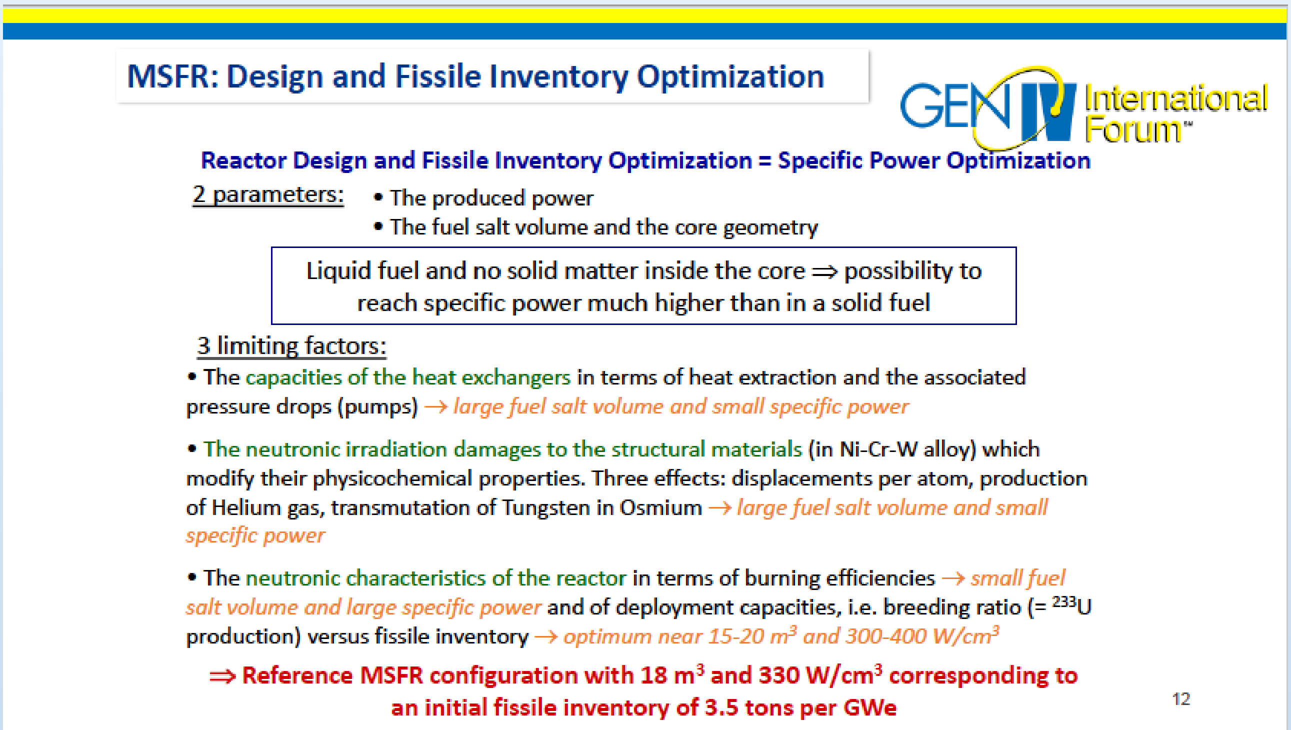
Liquid-fueled reactors exhibit unusual and interesting properties in terms of operation and safety compared to solid-fueled reactors, requesting a revision of some well-known conception and safety rules. In this webinar, such characteristics of the Molten Salt Reactors (MSRs) will be presented, together with the past and current R&D activities. The concepts studied in the frame of the Generation-IV international collaboration will be briefly described, and the presentation will then focus on the concept of Molten Salt Fast Reactor (MSFR), reactor based on a fast spectrum and studied since almost a decade mainly by calculations and determination of basic physical and chemical properties, initially at CNRS in France and now more largely in the European Union. The main design choices and characteristics of this MSFR concept will be explained and discussed including transient simulations, chemistry and material issues, safety analysis, research roadmap and laboratory scale experiments.

Meet the Presenter:

Prof. Elsa Merle is the director of the Master's Program in Reactor Physics and Nuclear Engineering at the PHELMA engineering school of Grenoble Institute of Technology, France. She is also working, as a research staff member, at the Laboratory for Subatomic Physics and Cosmology of Grenoble. Since 2000, she has been actively involved with the French National Center for Scientific Research (CNRS) programs dedicated to the conceptual design of innovative Generation IV reactors. As such, she is contributing to various studies and validations of the concept of Molten Salt Reactors and more specifically since 2008 on the definition and optimization of the concept of Molten Salt Fast Reactor (MSFR). Dr. Merle is in charge of the work-package 1 “Integral safety approach and system integration” of the Euratom project SAMOFAR of Horizon2020, and she represents CNRS at the GIF steering committee on Molten Salt Reactors.

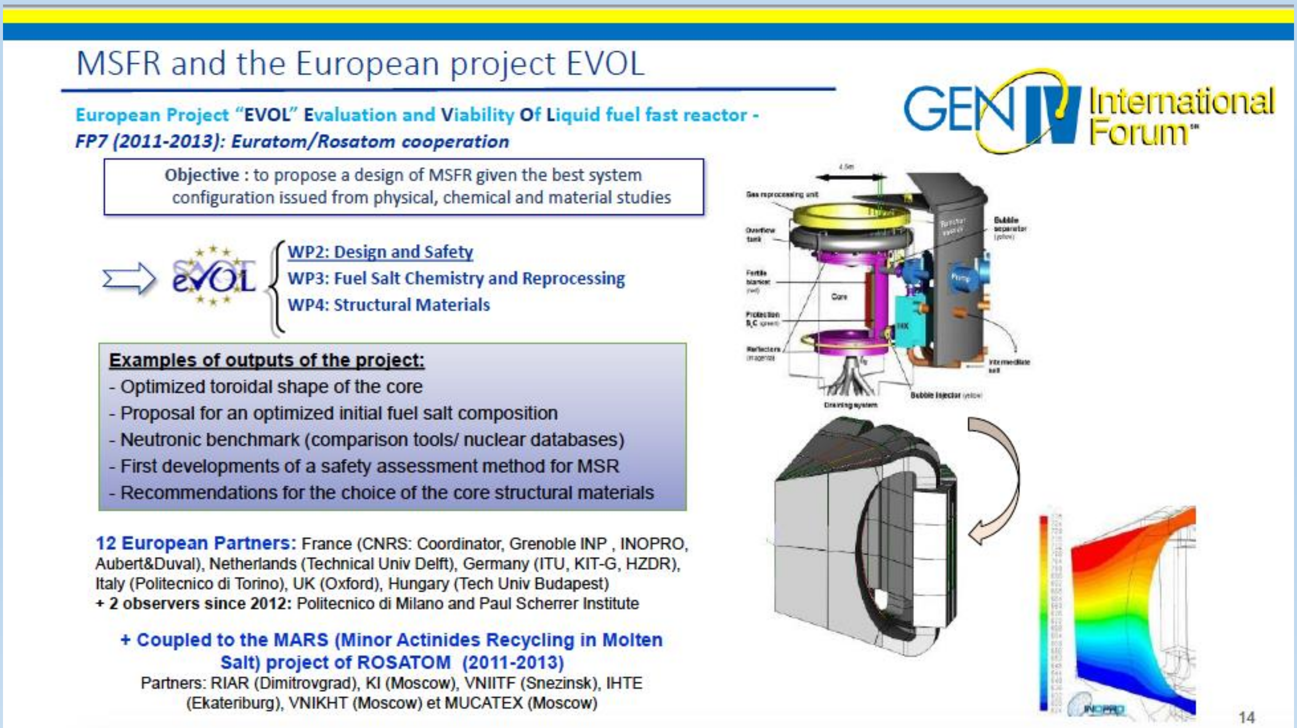
1. MSFR: Design and Fissile Inventory Optimization

The reference design parameters of power, fuel salt volume and core geometry have been decided considering some limiting factors.



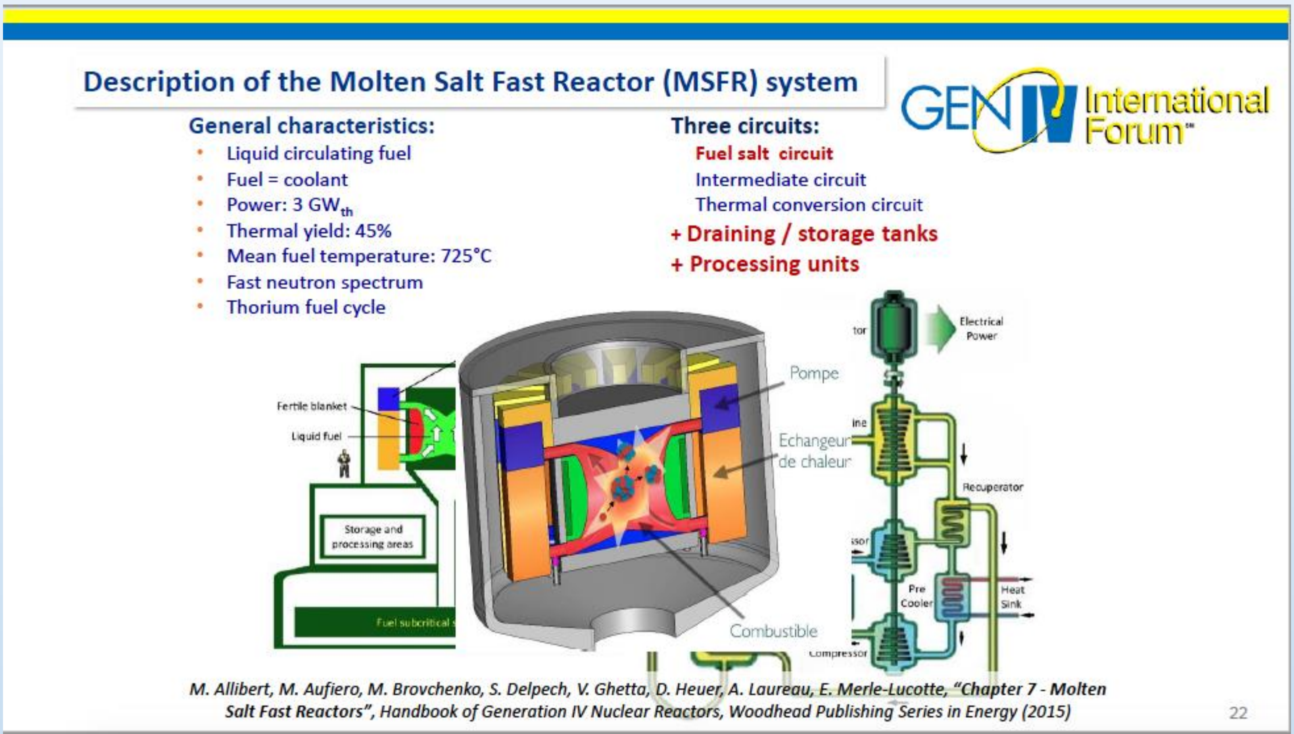
2. MSFR and the European project EVOL

EVOL project has been implemented during 2011-2013, in order to propose best MSFR system based on physical and material studies



3. Description of the Molten Salt Fast Reactor (MSFR) system

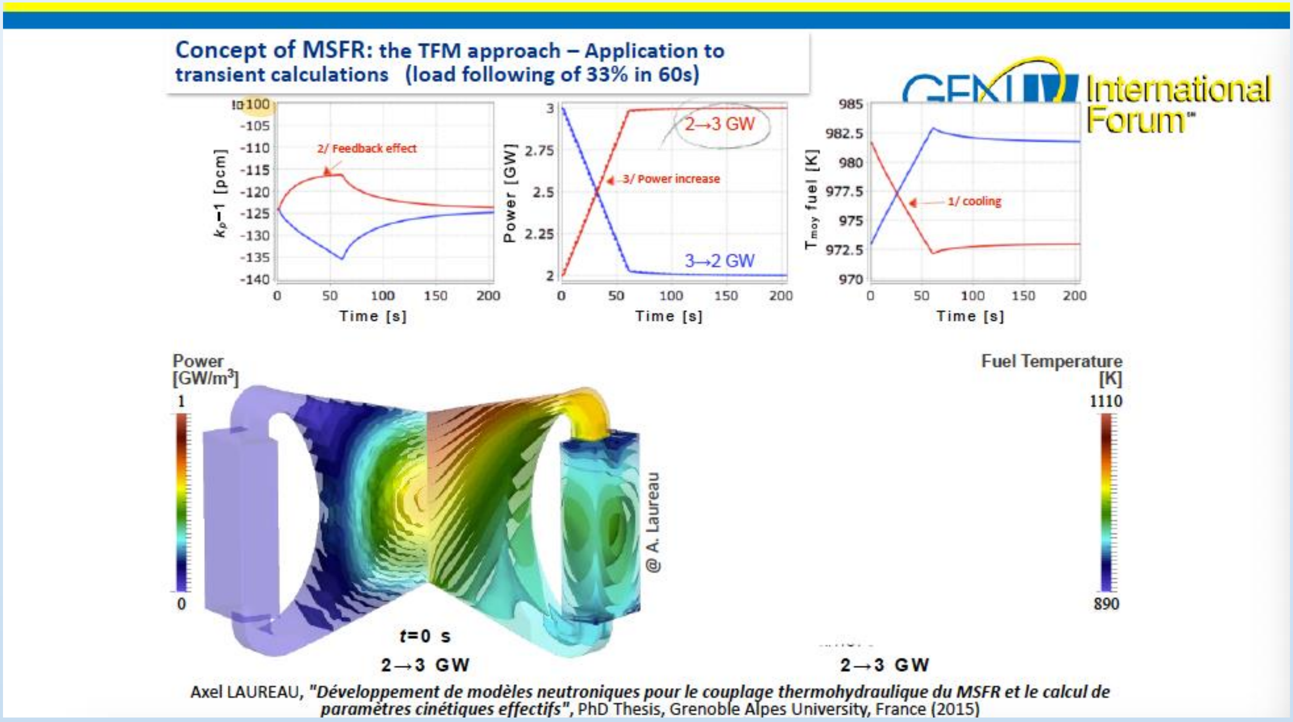
The main plant parameters, the heat transport configuration are shown.



4. SAMOFAR (Safety Assessment of a MOlten salt FAst Reactor) project

This European project has been performed during 2015-2019. They have discussed the safety approach considering the MSFR specific safety features.

5. An example of transient calculations (load following of 30% in 60s)
The Load following is driven by only the extracted power (no control rods needed). The excellent load following capacities of MSFR has been confirmed.



6. Safety Evaluation of the MSFR: barrier definition
How to assign the multiple confinement barrier function to the MSFR SSC (Structure, System, Components) is studied.