Analysis of the VHTR for Burning Plutonium

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Outline

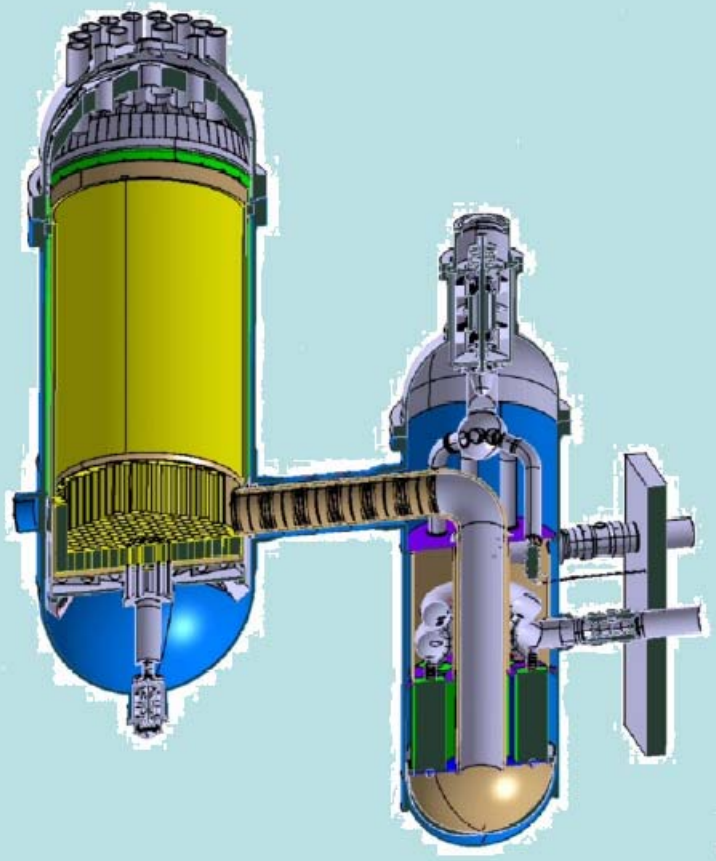
- Overview of project
- Description of VHTR
- Description of the model development
- Results expected

Overview of Project

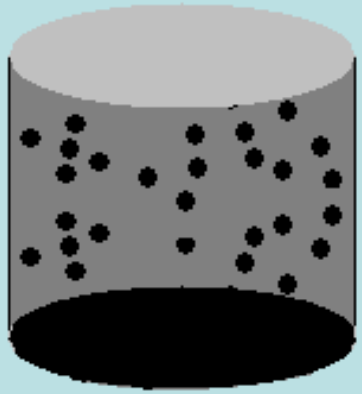
- Perform isotopic analysis of reactor with some simplifications
- Model VHTR with SAS2 with these same simplifications
- Vary fuel kernel radius and fuel concentration accordingly to find most efficient parameters
- Incorporate real situations with less simplifications

The VHTR?

- Possible Generation IV Reactor
- High outlet temperatures (appx. 1200 K)
- Prismatic and pebble bed designs. (Prismatic design considered in this work)
- Graphite moderated
- Gas cooled

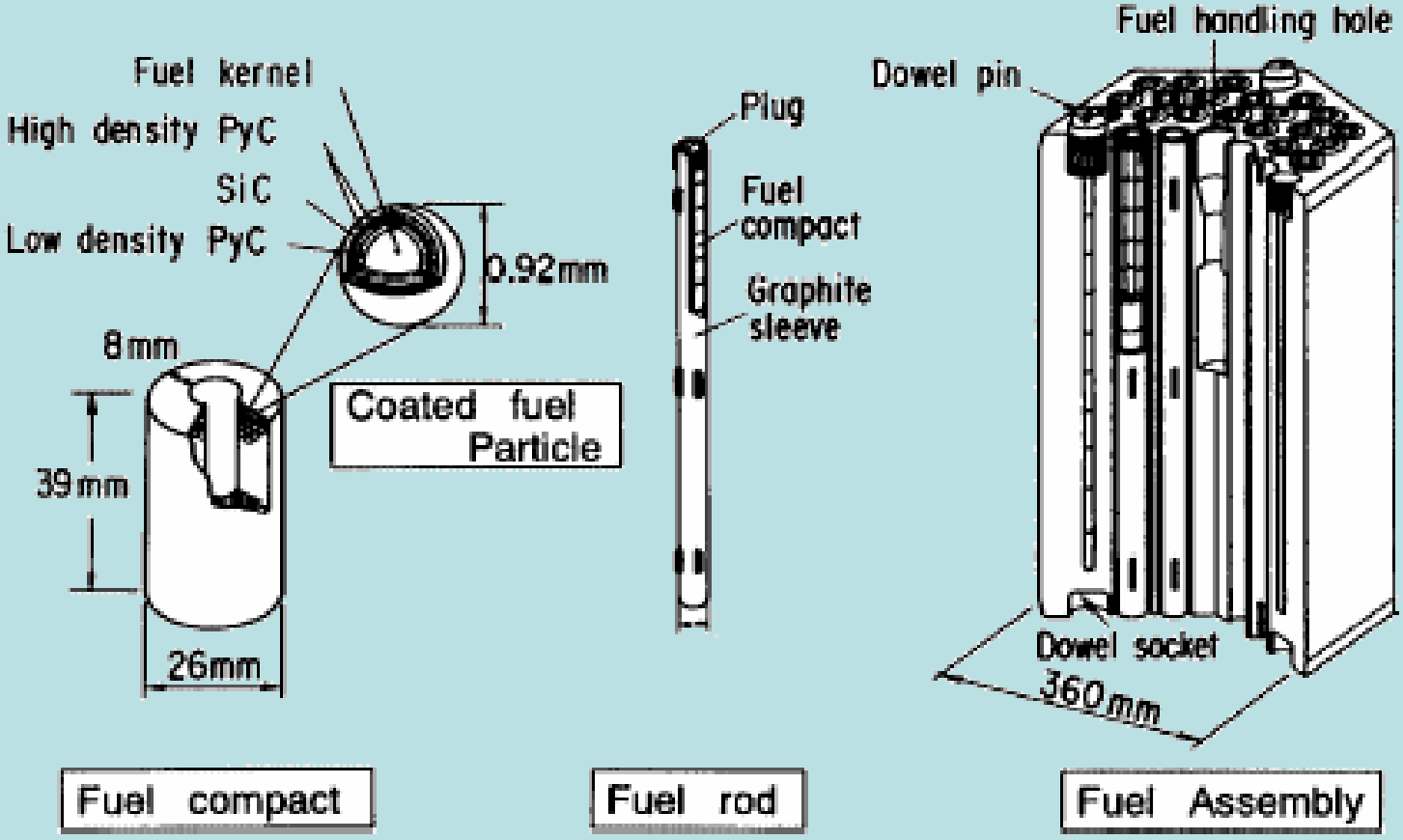


Analysis Overview



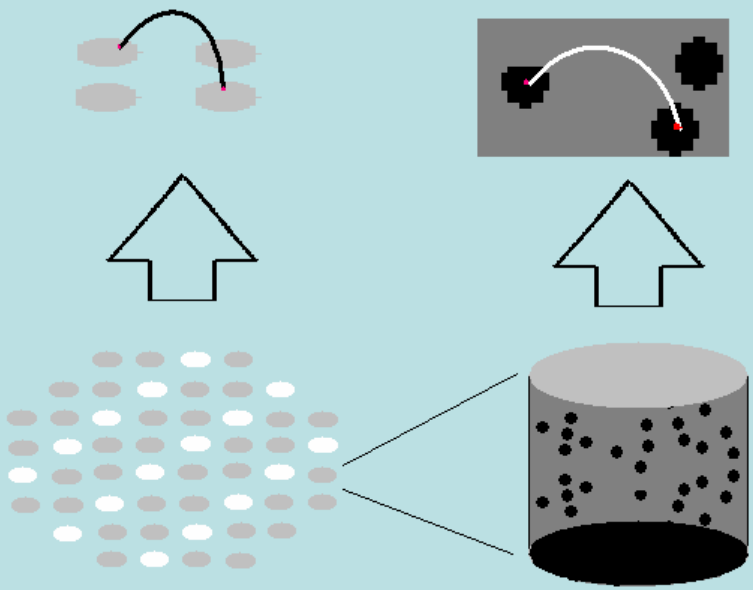
- Goal is to evaluate VHTR for burning plutonium in advanced nuclear fuel cycles.
- Must analyze neutron escape with two levels of Heterogeneity being taken into account
- Plutonium Dioxide as fuel rather than uranium dioxide used in LWRs and base VHTR design

VHTR assembly



Double Heterogeneity

- Neutron escape between fuel kernels at fuel particle level
- Neutron escape between fuel compacts
- Requires specific modeling to obtain correct resonance shielded cross sections



Model Development

- SAS2 used for analysis, shielding analysis code in SCALE
- SAS2 runs SCALE modules to obtain spent fuel characteristics
- “two-pass” method in SAS2 to account for double heterogeneity:
  - Pass 1 – 1D XSDRN calculation on fuel kernel level (spherical geometry)
  - Pass 2 – 1D XSDRN calculation on fuel compact level (cylindrical geometry)

Analysis Results Expected

- Calculations are currently being performed
- Model fuel burnup as a function of fuel loading and particle sizes
- Vary radius of fuel particle and concentration of Plutonium find most efficient system
- Plutonium used is from LWR spent fuel
- Fuel burnup considered is 60 MWd/MTU