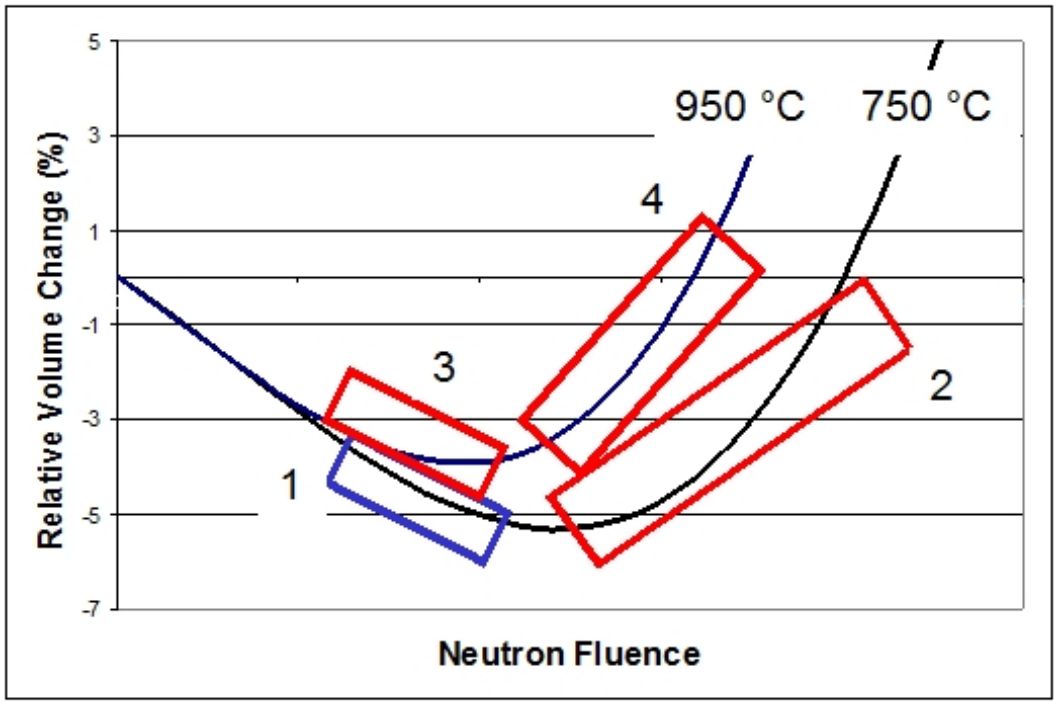
Subproject 4 addresses some key materials and component technologies important for the future development of the HTR as an efficient system for process heat applications and as a co-generator of electricity and for other non-electric applications.



An important milestone and result from ARCHER has been the completion of the graphite irradiation programme which aims to provide basic property data for the HTR core design. This irradiation programme is unique in the world as it provides results on the performance of the latest graphites produced by manufacturers for application to both the prismatic and pebble bed designs at temperatures up to 950oC. The graphite irradiation programme includes all graphites that are currently used in test reactors today including the graphite used in the core of the HTR-PM which is currently being constructed in China. The conclusions from this work are being shared within the Generation IV International Forum to help the development of HTR's across the world.

For the heat transport circuit and components such as the Intermediate Heat Exchanger (IHX) and the Steam Generator Unit (SGU), investigations have been carried out to extend the knowledge of the performance of Nickel based alloys that would be used in such components at temperatures up to 750oC. Specific tests have been carried out on Alloy 800H and other materials in high temperature corrosion loops and devices with results being obtained under simulated helium environments. The metals work has also addressed issues to benefit component integrity, providing tensile, creep and creep fatigue information base material and

welds for the developments being investigated in the two component work packages.

An Alloy 800H Compact Plate Stamped Heat Exchanger (PSHE) mock-up has been designed and manufactured using full sized plates but fewer in number than for a full sized IHX. CFD/FEM calculations have been performed to minimise the thermo-mechanical stresses under steady and transient conditions so that the length and the height were chosen to give smooth thermal gradients. The Compact IHX uses laser welding to join the plate stack and following successful manufacture and optimisation of the welding and machining processes to ensure the quality of the component, the IHX Mock-up has been successfully tested and cycled in a large Air Loop at temperatures up to 800oC. The results are being used to understand and assess integrity issues that will need to be addressed for the full sized version. This has been a significant achievement for all concerned and it is expected that the work in ARCHER will be an important milestone in ensuring that this technology is available for the HTR demonstrator and its process heat applications.

The work on the SGU has focused on issues important for selection and technology development. The work has considered transient requirements, material and fabrication issues, CFD and analysis investigations, monitoring and cost. A key objective was to choose the best option from the input requirements point of view and consider the technology issues and risks that would have to be addressed. The Helical design of SGU was chosen as the way forward with an arrangement based on a standard once through heat exchanger. The technology and roadmap developments required for this type of arrangement for HTR application have been established.