THEMAL ANALYSIS OF HIGH FLUX TEST MODULE WITH HORIZONTAL RIGS FOR IFMIF-EVEDA

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The control of the specimen temperature is one of the most challenging aspects of IFMIF's High Flux Test Module because of the non-uniformity of nuclear heating distribution in the Test Cell. Since the changes of mechanical and physical properties of materials due to irradiation strongly depend on irradiation temperatures and doses, specimen temperature must be carefully monitored for long-term irradiation periods. The irradiation temperature should typically range between 250 °C and 650 °C for RAF/M steels and up to 1,000 °C for SiC_f/SiC composites. As the high neutron flux volume is limited to about 0.5 liter, the size of all structural parts and elements controlling the temperature (cooling by gaseous helium and heating by electrical heaters) must be kept as small as possible. The concept of the High Flux Test Module with horizontal capsules (HFTM-H), object of the current technical specification, is based on the use of heater-integrated cast-like capsules (Figure 1). This concept is expected to enable an irradiation temperature of specimens up to 1000°C. In this concept, the specimens are irradiated in cast-like ceramic capsule with integrated electrical heaters. The ceramic capsule itself should provide enough thermal insulation. The array of cast-like capsules will be separated by narrow coolant channel.
This study aims to calculate the heater power distribution for 1000°C irradiation condition with the aid of out-pile experiment to measure the thermal properties of capsule materials. Figure 2 shows an example of temperature distribution of HFTM-H to uniform the capsule's temperature distribution.

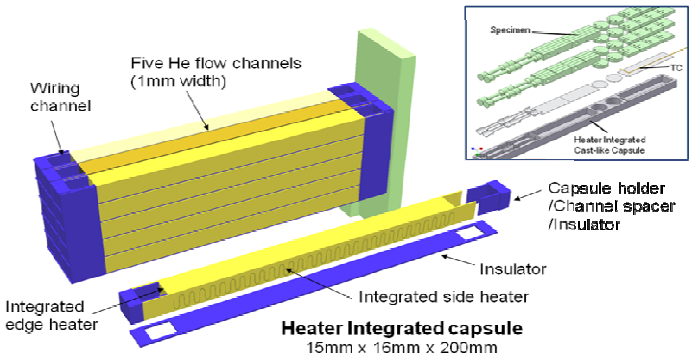

Figure 1: Conceptual design of HFTM-H

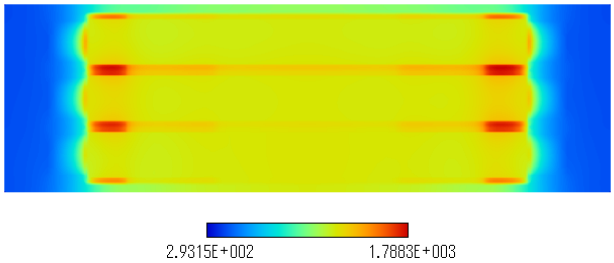

Figure 2: Temperature distribution of cross section of HFTM-H