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P3.210 Using sodium as filling and heat-conducting material in the irradiation capsules of the IFMIF-DONES

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The capsules of the IFMIF-DONES High Flux Test Module (HFTM) are packed densely with Eurofer specimens. A filling material (previously NaK-78 and presently sodium) is needed to fill any empty volume to improve the heat conduction and obtain uniform temperature distribution. Sodium is replacing NaK-78 because potassium generates argon isotopes leading to a pressure increase and formation of bubbles which counteract the purpose of introducing NaK-78 as a heat conductor. In this experimental study, two setups are used to investigate sodium as the new filling material. The first setup is dedicated to test the wettability of various specimens of Eurofer and stainless steel 316L by liquid sodium within the temperature range of 100°C to 430°C. The second setup consists of: (i) a full scale prototype of the HFTM capsule packed with Eurofer specimens, (ii) a stainless steel container for melting the sodium, and (iii) heaters, thermocouples and supporting parts. The objective is to demonstrate successful sodium filling and emptying of the prototype capsule and to determine how well the specimens are wetted and the empty volumes are filled with sodium. All experiments are performed inside a glovebox filled with dry argon to maintain an oxygen- and moisture-free atmosphere. The results of these experiments, which are relevant to IFMIF-DONES HFTM capsules and other sodium-using applications, are presented and discussed in this paper. For example, the results showed that efficient wettability of Eurofer and stainless steel 316L specimens by sodium may be assured when the temperature of the steel-sodium system is 430°C or higher.

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