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Thermal diffusivity of ceramic breeder beds

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In the solid Breeder Blanket (BB) concepts both tritium release and heat recovery depend on the thermal performances of the breeding zone. Within the R&D activities of the Helium Cooled Pebble Bed (HCPB) breeding blanket, the knowledge of the thermal diffusivity of the breeder beds is of fundamental importance to model the transient heat transfer during the power pulses of the fusion machine. The aim of the present study is to investigate the thermal diffusivity of the breeder beds at BB relevant conditions; to this end the line heat source probe method was employed. The method uses a linear heater (probe) embedded in the material to be investigated. The thermal diffusivity of the material is analytically derived by measuring the temperature rise as a function of time at a point close to the probe. By knowing the thermal conductivity of the material, the specific heat capacity can be derived in addition.

An experimental facility was conceived for the investigation of the thermal diffusivity of granular beds at breeder blanket relevant temperatures, mechanical state, purge gas type and pressure. Based on the geometrical restriction of the experimental facility, the experimental parameters were tailored with a series of FEM simulations to reduce the error of the measurements.

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