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INTERNAL RADIATION EFFECTS ON THE THERMAL RESPONSE OF HIGHLY POROUS MATERIALS IN RADIATIVE ENVIRONMENT

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ABSTRACT. In order to better engineer porous materials for specific applications, the knowledge of their thermal characteristics at high temperature is crucial for the prediction of their thermal behavior. We present results obtained with a combined experimental-numerical method considering and quantifying temperature-dependent effective thermal properties of mullite ceramics in a temperature range of 288 K to 1473 K. These foams are placed in EPFL's HFSS at a peak radiative heat flux of 1 MW/m2. A 3D numerical finite volume model based on an OpenFOAM toolbox was used to determine the effective thermal conductivity of samples with three different porosities. The model was then coupled to a 3D ray-tracing Monte-Carlo in-house code to separately model the radiative heat transfer through the studied samples. We quantify the effects of coupled conduction and radiation on the temperature fields inside the highly porous media.