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DETERMINATION OF THERMAL CONDUCTIVITY OF POROUS MATERIALS MANUFACTURED BY FAST/SPS BY DEM SIMULATION

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Numerical modelling of heat conduction using the discrete element method (DEM) will be presented. Numerical simulations have been performed to determine the effective thermal conductivity of porous materials manufactured by FAST/SPS. Sintered porous media can be considered as sphere particles connected by necks, which are created during the sintering process. Therefore the discrete element method employing bonded spherical particles is a suitable tool to model thermal problems of such systems.

The model discrete element method for heat conduction analysis developed is based on the thermal pipe-network approach. It employs lumped capacitances concentrated at the centres of the particles which are connected by heat-conducting bars (thermal pipes). The governing equations are based on the balance of the rate of heat-storing in the lumped capacitances and rate of heat flow through the pipes, and any other contributions of heat transfer. The effective thermal conductance of the pipe has been determined using the analytical approximation.

The DEM is applied to the simulation of transient heat flow in cylindrical samples built from spherical particles representing NiAl powder particles at a different stage of sintering. The steady-state temperature field is used to determine the effective thermal conductivity from the Fourier law of heat conduction. Numerical results have been validated using own experimental results. Quite a good agreement between numerical and experimental results has been found.

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