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Abstract

The modification of the temperature gradient in a large sample sintered by SPS

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The SPS is a sintering unit where heating and the uniaxial pressure is applied to a powder placed in a die. The best pressure and temperature distribution in the sample is achieved when the sample has the shape of a round pellet. In some cases it would be beneficial to be able to sinter square or rectangular plates. The processing of a large square/rectangular plate is a challenging task because the shape will increase the temperature gradient in the horizontal direction in the plate resulting to uneven properties in corners compared to the middle. In this study we present results of a simulation of the temperature gradient inside the plate of conductive material. The decrease in the temperature gradient was tried to achieve by directing the electric current towards the corners of the plate.

The Comsol multiphysics was used for modelling the temperature difference in the large square plate of conducting material. To make the simulation simple the die was removed from the test. This will increase the temperature difference and will make the improvement in the temperature distribution more visible. In the basic case the current passed the total area of the plate and the difference between the corners and middle of the plate is remarkable. The insulating layer was added and the temperature gradient was decreased. The results of the simulation were in the line of the experiments done with a large steel plate when the temperatures between the different areas were measured in-situ when the plate was heated.

Controlling the direction of the current in the case of a conducting material can increase the homogeneity of the samples sintered in the SPS.