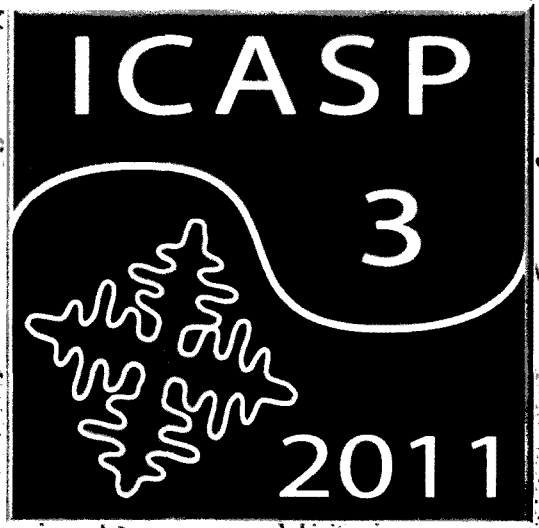
3rd International Conference on Advances in Solidification Processing



Abstracts Book

Aachen/Rolduc

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Optimization of processing parameters in laser sintering of metallic powders

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Optimization of laser sintering of submicron metal powders has been studied in connection with unsteady heat transfer in a porous powder layer under conditions of rapid phase transformations. The heating and cooling rates and depth of the sintered layer are estimated after analysis of geometrical characteristics of the metallic powder. Computer analysis revealed that the control parameters of the process are the scanning velocity and the permeability coefficient which depend on porosity and morphology of the powder layer. Effects of the laser annealing power, frequency of laser impulses and beam radius have a smaller effect on the depth of the sintering layer. At the porosity higher than 70%, the mechanism of heat transfer drastically changes and an approximation of continuum becomes incorrect. Full compaction of powder is depressed which degrades quality of the sintered layer. Its preliminary mechanical compressing via particle's ordering improves sintering and hence adherence of the coating to the substrate. Complex hierarchical structure of the sintered layer and heat transport at the scale of single particles (fig. 1) are discussed to suggest optimal processing modes of laser sintering.

Acknowledgement
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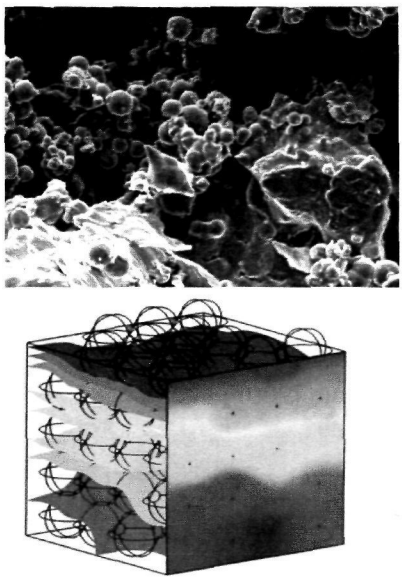

Fig.1: (left) SEM of the sintered layer reveals a hierarchical type of morphology. (right) Modeling of heat transport in a porous powder layer showed high inhomogenity of the temperature field in a mixture of particles of different sizes.