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Titel des Beitrags: A Smoothed Particle Hydrodynamics Model for Laser Beam Melting of Ni-based Alloy 718

Abstract:
Laser Beam Melting (LBM) – also referred to as Selective Laser Melting (SLM) – is an Additive Manufacturing (AM) technology and pertains to the Powder Bed Fusion (PBF) processes. Within this work a numerical simulation model of the LBM process based on the meshless computational method Smoothed Particle Hydrodynamics (SPH) in a multi-phase and weakly-compressible formulation is presented. Its implementation utilizes the parallelization capabilities of Graphics Processing Units (GPU) for achieving a reduced computation time. Physical phenomena such as thermal conduction, melting and re-solidification, convection and effects related to surface tension such as thermocapillarity are considered. Furthermore, the influence of the recoil pressure induced by evaporating atoms from the melt pool surface is taken into account. The material properties of relevance (e.g. dynamic viscosity, thermal conductivity and absorptivity) for the investigated alloy Inconel® 718 (respectively Alloy 718) are modeled by means of temperature-dependent functions. The underlying material data originate from literature. The simulation results
are compared with experimental findings for single melt tracks to evaluate the model validity with regard to the process parameters scanning velocity and laser power.

Stichworte:
Additive Manufacturing; Computational Fluid Dynamics (CFD); Inconel 718; Laser Beam Melting (LBM); Selective Laser Melting (SLM); Smoothed Particle Hydrodynamics

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