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2D numerical model for heat transfer on a laser deposited high entropy alloy baseplate using Comsol Multiphysics

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Abstract
In an optimization study, cracks were observed in the microstructures of laser-deposited HEAs on a steel baseplate from residual stresses, thus, the optimization of crack-free microstructures was achieved by the optimization of the laser parameters by baseplate preheating attributed to the lowering of the thermal gradients of the deposition process. This study reports the finite element analysis on the temperature distribution by the moving laser modelled to achieve process optimization with the necessary boundary conditions. Simulation has been reported as a facilitating tool in predicting the behaviour of materials during process optimization. Comsol Multiphysics 4.4, was used to create a 2D transient heat transfer time-dependent model to simulate the temperature distribution and the laser heating of the A301 steel baseplate surface and determine the effect of temperature on the optimization process of the alloys. Gaussian profiles were used as the heat source distributed per time. The results are presented in terms of thermal fields and Gaussian temperature profiles. Which show the temperature distribution that occurred in the steel baseplate during fabrication and the high cooling rate of the laser additive manufacturing technique restricted thermal stresses, improving adhesion and facilitating the optimization process.