

Benefit Of Vapor Consideration For LPBF Additive Manufacturing Process Simulation

Morgan Dal¹, Julien Daligault¹, Jérémie Girardot²

¹Laboratoire PIMM, Arts et Metiers Institute of Technology, CNRS, Cnam, HESAM Université

²I2M, Arts et Metiers Institute of Technology, University of Bordeaux, CNRS, Bordeaux INP, INRAE

Abstract

Simulation of laser processes are more and more efficient. In some cases, as welding and additive manufacturing, the physical phenomena are complex, multi-physics and multi-phases, thus some assumptions have to be done. For Laser Powder Bed Fusion, a laser beam melts and vaporizes the substrate and powder materials. In literature, the vaporization process is supposed to produce a recoil pressure at the surface of the liquid but the momentum created on the gas is usually neglected. In the present paper, authors focus on this particular part of the model in order to prove the benefit of such consideration. The whole model is described (heat transfers, fluid flows, phase field) and the vapor consideration is detailed physically and numerically for two assumptions : pressure model and momentum model. After having shown some numerical comparisons illustrating the benefit of this method, a short physical analysis is made to conclude on the sensitivity of the vaporization phenomenon on the process.

Figures used in the abstract

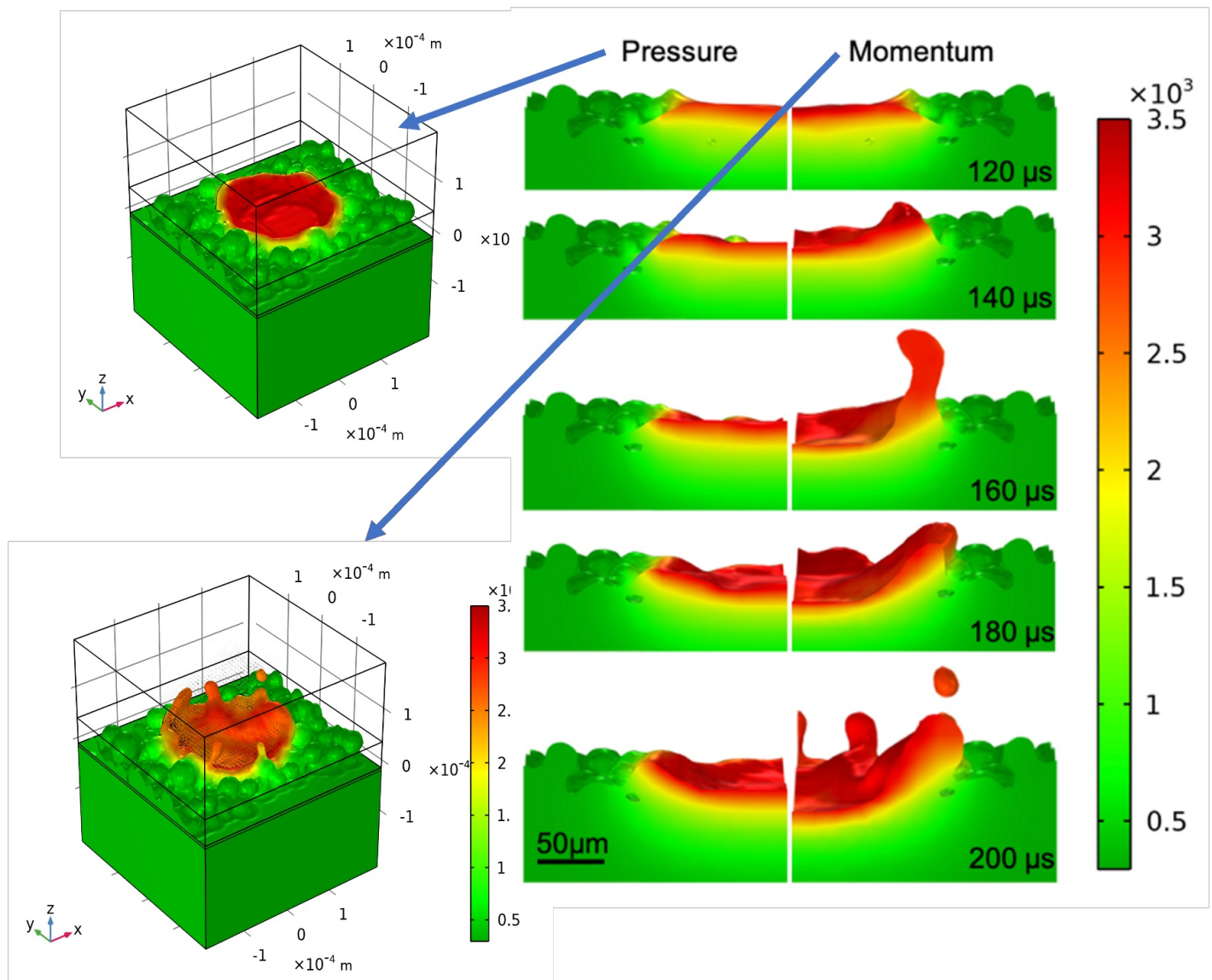


Figure 1 : Comparison of thermal fields computed with the pressure model and the momentum model (color is the temperature)

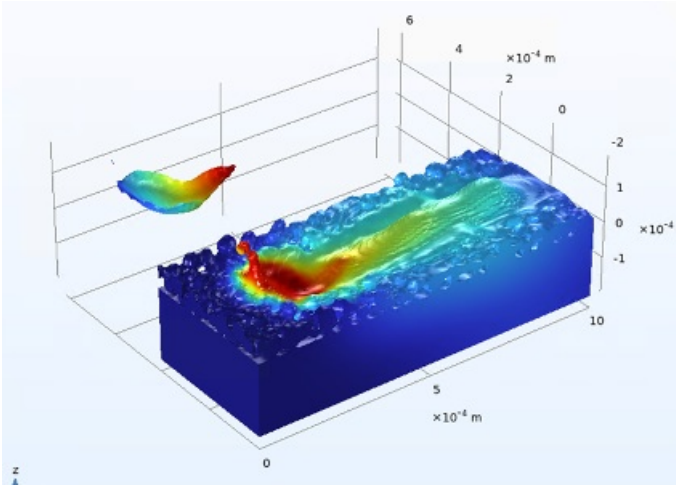


Figure 2 : Example of track instabilities calculated for 320W and 0.33 m/s process parameter on stainless steel.