20th European Mechanics of Materials Conference - EMMC20
Florence, Italy | May 27th-29th, 2026
www.emmc20.unifi.it

Role of a high-temperature heated build platform for printing brittle ferromagnetic Fe-6.5wt%Si alloy via laser powder bed fusion

Simon Van Roy[1], Bruno Dehez[2], Olivier Poncelet[3], David Reuter[4], Olivier Rigo[5], Arnaud François[6], Aude Simar[7]

[1] UCLouvain, Institute of Mechanics, Materials, and Civil Engineering (iMMC), Belgium. simon.vanroy@uclouvain.be
[2] UCLouvain, Institute of Mechanics, Materials, and Civil Engineering (iMMC), Belgium. bruno.dehez@uclouvain.be
[3] UCLouvain, Institute of Mechanics, Materials, and Civil Engineering (iMMC), Belgium. olivier.poncelet@uclouvain.be
[4] Sirris, Belgium. david.reuter@sirris.be
[5] Sirris, Belgium. olivier.rigo@sirris.be
[6] Cenaero, Belgium. arnaud.francois@cenaero.be
[7] UCLouvain, Institute of Mechanics, Materials, and Civil Engineering (iMMC), Belgium. aude.simar@uclouvain.be

Paper ID: 53
Symposium S6: Additive manufacturing: challenges and solutions

Abstract

The reduction in fossil fuel usage and the transition toward full electrification across multiple sectors are driving an increased demand for electromagnetic actuators. For the aerospace sector, minimizing actuator mass is critical as it is directly linked to consumed fuel. In this context, lightweight designs are essential for performance and efficiency. Additive manufacturing, with its reduced manufacturing constraints, offers a promising solution. In particular, the rapid cooling rate inherent to Laser Powder Bed Fusion (L-PBF) enables the processing of brittle high-silicon Fe-based soft magnetic alloy that is otherwise difficult to fabricate using conventional methods. This ferromagnetic alloy exhibits good electromagnetic properties and particularly low hysteresis and eddy current losses. However, its brittle nature makes the printing process challenging, only a few studies fabricated defect-free

samples by using a high temperature heated build platform (HBP). This study investigates the influence of process parameters—specifically HBP temperature and post-process heat treatment—on the properties of Fe-Si alloys. Defect appearance conditions are discussed, followed by a comprehensive evaluation of mechanical, electrical, and magnetic properties. This research provides deeper insights into defect formation mechanisms in brittle materials processed with high-HBP L-PBF and their impact on material performances.

Keywords:

laser powder bed fusion Fe-Si brittle heated build platform ferromagnetic crack mitigation