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EDITORIAL

FFEMS Fatigue & Fracture of Engineering Materials & Structures WILEY

Virtual special issue: Fatigue and fracture of additively manufactured materials

Additive Manufacturing (AM) technology makes possible the direct conversion of digital complex shapes into physical products. This can be done automatically only with one production step with less waste of time and material with respect to traditional manufacturing processes. Over the last years, AM technology has incredibly evolved allowing to produce complex parts at different scale levels and for different strategic and sensitive industrial and engineering applications positively impacting on the overall economy. AM can be used in fact from prototyping to production and repairing of functional industrial components ready for service. This revolution has touched almost all the categories of materials allowing also to produce unprecedent material structures that can be tuned for multi-functional applications.

The diffuse use of AM technology has, in parallel, increased the importance of understanding and predicting the overall mechanical performance of AM parts. Structural integrity of AM products is in fact a key issue for the spreading of this technology in load-bearing applications. Many questions are still open especially for the newly developed materials. How the microstructure of printed material, surface condition, and statistics of the internal defects influence the final mechanical behavior is still not a completely answered question.

The present virtual special issue (VSI) is dedicated to the Fatigue and Fracture of Additively Manufactured Materials. The aim is to provide an overview of recent interesting aspect related to this research field touching the open issues that can be relevant for the final design. Thus, this VSI embraces different works aimed to understand and deploy physics of fatigue and fracture of AM materials produced with the different available technologies giving an update state of the art on the topic. The VSI contains 11 papers from invited researchers. The focus of these papers is different. Some contributions are mainly aimed to understand the effect of process parameters on the final structural integrity.[1] Different building directions and pre-heated platform have been considered[2] together with other process parameters. Laser power, scan speed, layer thickness, and hatch spacing have been carefully investigated as well. The effect of hot-isostatic pressing on the fatigue strength of Ti6Al4V has been systematically discussed in Jesus et al.[3] Cellular structures employed in conventional and advanced bio-medical applications have been carefully investigated in Bellini et al.[4] and Raghavendra et al.[5] under quasi-static conditions. Different wall thicknesses and their effect on the final fatigue strength of additively manufactured E-PBF Ti-6Al-4 V has been addressed in Segersäll et al.[6] The importance of defects and their impact on the final fatigue resistance has been considered taking into account multiaxial loadings[7] and the statistical distribution of defects inside the component.[8] An interesting aspect of additively manufacturing processes is the anisotropic behavior under fatigue loading. Light on this interesting topic has been placed by a contribution published inside the present special issue.[9] Finally advanced metallic[10] and polymeric materials[11] produced by AM have been considered with particular attention to their mechanical properties focused to real engineering applications.

All the papers have been subjected to the standard peer review process commonly employed by FFEMS.

As Guest Editors of this VSI, we are satisfied of the final result and hope that the present papers could be useful to researchers, designers, and colleagues who are involved, for different reasons, in the design of AM components.

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