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Correlation between surface texture and internal defects in laser powder bed fusion additive manufacturing

Hideki Kyogoku
Kindai University, Japan

Additive manufacturing is an essential technology in digital manufacturing and has been widely applied in various fields. However, because the intrinsic properties of the laser powder bed fusion (PBF-LB) process lead to the generation of defects in manufactured products, the development of a real-time monitoring and feedback control technology is demanded to assure the final product quality and process repeatability. Therefore, we focuced on the correlation between the surface-texture parameters and density or internal defects, which is yet to be quantitatively investigated in a systematic manner, to predict th egeneration of defects. This study aims to investigate the correlation between the surface texture and internal defects or density of PBF-LB parts, thereby providing guidelines for the development of an in-situ monitoring and feedback control system capable of preventing defect occurrence in PBF-LB parts. In this study, PBF-LB specimens are fabricated under various power and scan-speed conditions using a PBF test bench. CSI equipment (Zygo newview9000) was used to determine the ISO25178-6 areal surface-texture parameters for the fabricated specimens. Consequently, the density and 35 areal surface-texture parameters of 121 manufactured specimens were determined. Using a statistical method, a strong correlation was revealed between the areal surface texture parameters and density or internal defects in the within specimens. In particular, the parameters Svk, Sk, Sq, and Sdq demonstrate a strong correlation with specimen density. Therefore, in-situ monitoring of these areal surface-texture parameters can facilitate their use as control variables in the feedback system to prevent defect generation during the PBF-LB process.

Biography

Hideki Kyogoku has completed his Doctor of Engineering degree in Mechanical Systems Engineering from Tokyo Institute of Technology in 1989. He is a Professor of Fundamental Technology for Next Generation Research Institute and the director of the Advanced Additive Manufacturing Research Center at Kindai University. He worked at The University of Texas at Austin as a visiting research associate during 2001-2002. He serves as the Project Leader of Technology Research Association for Future Additive Manufacturing (TRAFAM) from 2014. He has published more than 100 papers in reputed journals and has been serving as an editorial board member of repute.