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Internal defects and their correlation with surface texture in laser powder bed fusion additive manufacturing

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Additive manufacturing is a crucial technology in digital manufacturing, finding applications across various fields. However, defects in products often arise due to the inherent properties of the laser powder bed fusion (PBF-LB) process, highlighting the need for real-time monitoring and feedback control technologies to ensure product quality and process consistency. This study focuses on systematically investigating the correlation between surface texture parameters and internal defects or density in PBF-LB parts, an area that has yet to be quantitatively explored.

The objective is to examine how surface texture correlates with internal defects and density in PBF-LB parts, providing insights for developing in-situ monitoring and feedback control systems to prevent defects. PBF-LB specimens were fabricated under various power and scan-speed conditions using a PBF test bench. The ISO 25178-6 areal surface texture parameters were measured using CSI equipment (Zygo NewView 9000) for the fabricated specimens. This study assessed the density and 35 areal surface texture parameters of 121 specimens. Statistical analysis revealed a strong correlation between the areal surface texture parameters and the density or internal defects of the specimens. Specifically, parameters such as Svk, Sk, Sq, and Sdq showed a strong correlation with specimen density. Therefore, monitoring these areal surface texture parameters in-situ could be used as control variables in feedback systems to mitigate 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.