**Air-Coupled Ultrasound Characterization of the Surface and Bed Consistency of Metal Powder Spread in Laser Powder Bed Fusion (LPBF)**

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ABSTRACT

The consistency of the powder bed, including the conditions at the surface and through its depth, in laser powder bed fusion (LPBF) processes of additive manufactured (AM) components determines the uniformity of bulk properties of the build part. To establish the ability of several non-destructive approaches for characterizing the metal powder bed condition, air-couple ultrasound has been applied. This work is intended to establish the link between ultrasound response and the surface condition of the powder bed as well as evaluate the ability of the impinging ultrasound to characterize the condition of the bed at various depths. With the use of focused probes operated in both one-sided pitch catch (OSPC) and pulse-echo (PE) configurations, C-scans will be used to gage spatial variation in powder bed samples in both the time and frequency domains. Initial efforts to measure local powder areal density in shallow beds and compare this to ultrasound response employed glass bottomed beds. Here, high intensity light is projected through the powder bed and captured via camera similar to x-ray densitometry.

**Keywords:** Ultrasound, Ultrasonic, Nondestructive Evaluation, Laser Powder Bed Fusion, Metal Powder, Additive Manufacturing

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