Nondestructive Evaluation (NDE) techniques are needed to validate the additive manufacturing (AM) process performance. The lack of adequate NDE techniques for examination before, during and after AM component fabrication was identified as one of the main current challenges [1]. X-ray computed tomography (CT) was selected as primary technique for post-process inspection of components with complex shapes where the advantages of AM are fully realized [2]. To establish an initial baseline of CT data, Direct Metal Laser Melting (DMLM) and Electron Beam Melting (EBM) were used to fabricate coupons and complex geometry aerospace components with typical flaws and conditions. A flaw matrix was designed and the two processes were optimized to produce the desired flaws necessary for verification of CT performance in Inconel 718 and Ti-6Al-4V. Four coupon batches were fabricated. Surface and subsurface flaws were implanted such as pores, up to 135 AM process induced, and 8 machined artificial flaws. All four batches were CT inspected to measure the flaws and compare with the matrix to qualify the flaw fabrication process and determine the range of flaws that could reliably be produced. Coupons were sectioned to verify the CT measurements. CT data showed residual powder and differences between surface and subsurface flaw morphology. Results will be used in subsequent phases of the project to build and CT inspect components with complex shape and geometry for establishing CT baseline capabilities.

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References: