Announcing the Final Examination of Asif Mahmud for the degree of Master of Science

Time & Location: June 29, 2020 at 10:00 AM in Virtual Defense
https://ucf.zoom.us/j/92982266282?pwd=NzJTUDZhZXV6cGJuEc4Y2IrNHZyQT09
Title: Mechanical Behavior Assessment of Ti-6Al-4V Alloy Produced by Laser Powder Bed Fusion

The present work correlates quasi-static, tensile mechanical properties of additively manufactured Ti-6Al-4V (Grade 23) alloy to the phase constituents, microstructure and fracture surface characteristics that changed with post-heat treatment of stress relief (670 °C for 5h) and hot isostatic pressing (HIP with 100MPa at 920 °C for 2h). Ti-6Al-4V alloy tensile specimens in both the horizontal (i.e., X and Y) and vertical (Z) directions were produced by laser powder bed fusion (LPBF) technique. Mechanical properties were determined using quasi-static, tensile testing for both the as-stress-relieved (ASR) and HIP specimens. For the ASR and HIP samples built in X, Y and Z directions, density by Archimedes principle and image analysis, phase constituents by X-ray diffraction and Rietveld technique, microstructure and fracture surface by optical and electron microscopy, and microhardness by Vickers were examined. Higher yield strength (1141 MPa), higher tensile strength (1190 MPa), but lower elongation at fracture (6.9 %) along with a mechanical anisotropy were observed for ASR samples. After HIP, an isotropic mechanical behavior was observed with a slight reduction in yield strength (928 MPa) and tensile strength (1003 MPa), but with a significant improvement in elongation at fracture (16.1%). These properties satisfy the industry specification. Phase constituents of acicular alpha prime phase in ASR and lamellar alpha + beta phases in HIP samples were consistently observed to substantiate the reduction in strength, but the anisotropic variation in elongation at fracture observed for the ASR samples was related to the presence of "lack-of-fusion" flaws.

Major: Materials Science and Engineering

Educational Career:
Bachelor's of Materials and Metallurgical Engineering, BS, 2017, Bangladesh University of Engineering and Technology

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Approved for distribution by Yongho Sohn, Committee Chair, on June 10, 2020.

The public is welcome to attend.