EFFECT OF POWDER MORPHOLOGY AND LASER SCANNING ON TRACK SURFACE CHARACTERISTICS OF LASER- POWDER BED FUSION OF TI-13%NB-13%ZR ALLOYS

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Selective laser melting (SLM) is a technology of additive manufacturing (AM) that offers several benefits to the fabrication of materials. This approach can create complex and customized parts in a rapid and precise way depositing powder in the form of repetitive layers that are selectively molten. The Ti-13%Nb-13%Zr alloy has showed good corrosion resistance, low modulus and good bio compatibility, justifying the effort for this research and presenting the surface characteristics after the Ti-13%Nb-13%Zr processed by SLM.

The last horizontal layer fabricated by laser-powder bed fusion exhibits several characteristics that are sensitive to powder morphology, laser power, laser speed and laser strategy: V-shaped melt pool solidification marks, spherical spatter, holes, surface roughness in islands borders when using chessboard strategy and other defects.

For spherical powder morphology obtained by plasma atomization (PA), the track surface characteristics of three different scanning strategies with the same laser power were compared: Defects found on the chessboard strategy specimens surface presented spherical and regular morphology, whereas defects found on the X-X parallel strategy presented irregular morphology.

Using chessboard strategies, 1100 mm/s specimen showed less spatter defects, more irregular defects and less superficial roughness than 1400mm/s specimen which, in turn, showed bigger roughness, and superficial holes.

For the same scan speed and power, the comparison between plasma atomization (PA) and hydride-dehydride (HDH) samples resulted in more spatter defects, and more irregular particles in the HDH samples.

Chessboard strategy with border position shifting between layers role integrated the layers and avoided the formation of a vertical division between the

islands that occurred when no shifting was experimented. Simultaneous variation on energy density and powder morphology were performed and it was possible to realize that the specimen produced by HDH method and smaller energy density presented more balling defects and bigger superficial roughness than the PA specimens produced using double the energy density.

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