Wear studies of Fe-based self-lubricating nanocomposites produced by laser cladding process

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The laser cladding process is one of advanced tools for metallic materials processing most widely used, through various routes and from different types of lasers[1]. Regarding surface treatment, comprising a restricted area, it is possible to improve significantly mechanical properties, corrosion and wear resistance[2]. Self-lubricating nanocomposites were produced using a mixture of the powders of $Fe_{60}Cr_8Nb_8B_{24}$ (at%), prepared by high-energy ball milling (MAE) with size range from < 45 μm, and MoS_2 (5.0 wt%), size range from < 3 μm. The mixture were used to produce coatings on to AISI 1020 mild steel substrate by pre-placed powder laser cladding. Several coatings were produced using different laser processing parameters, laser power (W) and scanning speed by means an Yb fiber laser (up to 2 kW) IGP, on the air, only with an argon gas flux on to sample. The coatings were characterized by scanning electron microscopy (SEM), X-ray diffraction (XRD) and submitted to wear measurements. In addition, the coatings were produced using different overlaps, 50%, 75% and 90%. SEM and XRD analyzes of the single tracks produced by laser cladding showed a nanocrystalline microstructure with very nanopores and peaks of nanocrystalline α-Fe and MoS_2 phases, regardless of laser parameters, respectively. In addition, broad peaks were seen, indicating low crystallinity of the single tracks (remaining amorphous phase). In this work, the effects of the different overlaps were evaluated on the features of coatings, microstructural, phase composition and wear.

References

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