ABSTRACT

Multi-component composite coatings and alloyed layers were synthesized separately by laser cladding (LC) and laser surface alloying (LSA) respectively on Ti-6Al-4V substrate with pre-placed powder mixture of titanium (Ti), silicon carbide (SiC) and hexagonal boron nitride (h-BN). The XRD spectra indicate that the coating contains Si_3N_4, Ti_5Si_3, Ti_3SiC_2, TiB, TiCN, TiC, TiN, and α-Ti phases. TEM micrographs indicate the formation of nanocrystalline particles and amorphous phases inside the coating. The micro-hardness values of coatings are found to be higher than that of the substrate. The wear rate of the coatings are found to be decreased with increase in normal load and sliding speed and the coefficients of friction of coatings are found to be increased with increase in normal load and sliding speed. The other test results also indicate that the *H/E* indices (*H*=hardness, *E*=elastic modulus) of coatings are higher than that of the Ti-6Al-4V substrate. The brittleness indices (H/K_{IC}) of coatings are found to be increased with increase in scanning speed at constant laser power. The further research work has been carried out in laser surface alloying (LSA) of the same precursor with and without rare earth oxide (Y_2O_3) addition on the Ti-6Al-4V substrate. The test reports indicate that the micro-hardness of alloyed layers without and with Y_2O_3 addition is higher than that of the Ti-6Al-4V substrate. The coefficients of friction of alloyed layers without Y_2O_3 and with Y_2O_3 are found to be lower than that of the substrate. The wear resistance of the alloyed layer with Y_2O_3 addition is found to be higher than that of the Ti-6Al-4V substrate. Also, the *H/E* indices of alloyed layers with Y_2O_3 addition are higher than those of the alloyed layers without Y_2O_3 addition. Furthermore, it was found that the brittleness indices (H/K_{IC}) of alloyed layers with Y_2O_3 addition are lower than those of the alloyed layers without Y_2O_3 addition. Hence, the wear resistance of the alloyed layers with Y_2O_3 addition is found to be higher than those of the alloyed layers without Y_2O_3 addition.

Keywords:- Coating; Alloyed Layer; Laser Cladding (LC); Laser surface alloying (LSA); Fracture Toughness; Tribological performance.