Abstract

In the present thesis some remedial measures, for problems encountered during development of bulk, hard and wear resistant laser clad layers on difficult to clad materials like Ti-6Al-4V and Al substrates, were undertaken. About 50 μm thick laser clad layer having nano-structured reinforcements and a hardness of about 2250 HV could be developed by self-propagating high-temperature synthesis (SHS) of 100 μm thick preplaced powder mixture consisting of Ti, *h*BN, and B_4C on Ti-6Al-4V substrate. On the other hand, the material could not be deposited due to powder-flying-off as a result of highly vigorous SHS in-situ reactions when a thicker preplaced powder layer (more than 300 μm) of the same composition was used. For reducing powder loss, Ni_5Al and Ni powders were sequentially used with the reactants as diluents, and material deposition was found to be improving. Ni layer was introduced as an intermediate coat layer which resulted in further improvement in material deposition and reinforcement distribution. Furthermore, multicomponent coatings, having a thickness of 1 mm and hardness of about 1200 HV with uniformly distributed reinforcements, were developed. Ex-situ coatings were also attempted on a Ti-6Al-4V substrate using WC reinforcements. Cracks and porosities were significantly reduced in the WC reinforced coatings when Diamalloy (DA), instead of Ni, was used with WC. About 1 mm thick laser coatings with a hardness of about 1800 HV could be developed on Ti-6Al-4V using WC+DA composition. The coefficient of friction for the developed coatings was significantly low in dry sliding wear tests. Experimental investigations were also performed on the development of multicomponent reinforced, hard and bulk coatings on Al substrates. Laser treatment was found to be easier when Al substrates were Ni-electroplated, and coating powder was preplaced over it. About 1 mm thick multicomponent coatings, with uniformly distributed reinforcements, could be developed using preplaced powder mixture of Ni_5Al, B_4C, and SiC on Ni-electroplated Al substrate and a wear resistant coating with peak hardness about 900 HV could be obtained. Finally, grindablity tests, on clad layers using WC+DA preplaced powders, were conducted to investigate the stability of clad layers, bonding strength as well as possibility of finishing the coating top surface for precision engineering applications. The hard clad layer was grindable by an electroplated diamond wheel and its strong adherence to the Ti-6Al-4V substrate was evident.