It is an advanced surface modification technology by laser cladding in-situ synthesis of ceramic particles, which can improves surface properties without changing the matrix material, such as wear resistance, corrosion resistance, oxidation resistance, thermal shock resistance and other properties. Due to the difference of parameters of the alloy matrix and the applied ceramic phase and their little compatibility, the interface bonding strength is low between the matrix and the reinforcing phase,which becomes the source of defects such as microcracks in the coating. This article studies the abrasion resistance of $WC-B_4C$ reinforced Ni-based composite coating on steel A3.

Cut the Hot-rolled A3 steel into long squares of 100mm×35mm×20mm as the base materials and smooth them by sandpaper and cleaned. Add different proportions(5%, 10%, 15%, and 20% quality scores) of $(WO_3+B_2O_3+C)$ as a cladding powder in Ni60, addition according to$2WO_3+2B_2O_3+9C=2WC+B_4C+6CO_2\uparrow$ molar ratio. Pre-coat the evenly mixed powder on a clean A3 steel surface. Apply the TJ-HL-5000 CO_2 multimode laser in the experiment. the moving speed of the spot is 2 mm/s during the cladding process, the defocusing amount is 50 mm, and the single pass cladding power is 1.4, 1.6, 1.8, 2.0 and 2.2 kW, respectively; The laser power of the multi-pass cladding is 2.0 kW, and the overlap between the two adjacent passes is 30%.Cut the sample with wire cutting and polish the cross section, and corrode it with 8% $FeCl_3$ solution. Then, observe the microstructure of the cladding layer by metallographic microscope (4XB-TV) and a scanning electron microscope (JSM-6700F). Then the component is analyzed by the EDS spectrum of each selected point taken by an energy spectrometer. Analyze the phase composition of the coating by an X-ray diffractometer (Bruker D8) and test the microhardness of the cladding layer and matrix by microhardness tester (HXDl000). The friction test is performed on a high speed ring block friction and wear tester (MRH-3). Calculate the weight loss of the friction mill and observe the morphology after the friction surface.

A well-formed WC/B_4C particle nickel-based reinforced composite coating is successfully prepared by laser cladding on the surface of A3 steel. The content of $(WO_3+B_2O_3+C)$ 10wt%, defocusing amount 50mm, laser power 2.0 kW, scanning speed 2mm/s are the best experimental preparation process parameters. The dendrite and network structure of reinforced composite coating form at the bottom and the middle and upper portions, respectively. The powder melts and chemically reacts with the C powder rapidly in a high temperature molten pool, forming $WC-B_4C$ in it. The remained elements of C, B, Cr and Ni form into $Fe_xNi_{23-x}B_6$ and CrC in the molten pool, which precipitates before the melt is completely solidified, forming a eutectic structure with $FeNi_3$ solid solution. The average hardness of the cladding layer with WC-B_4C hard phase is as high as $HV_{0.3}1200$, and wear resistance is 3 times that of Ni60 cladding layer.

A cladding layer with excellent performance can be formed under the optimal parameter process. The in-situ WC-B_4C enhanced phase is the main reason for the significant improvement in wear resistance in the cladding layer. The reticulated crystal structure effectively reduces the occurrence of cracks and frictional shedding.