**Nanomechanical characterizations of ceramic coatings deposited using laser cladding**

*Yitian ZhaoA, Mingyuan LuA, Han HuangA*

ASchool of Mechanical and Mining Engineering, The University of Queensland, Brisbane, Australia

Dense titanium oxide and titanium oxynitride ceramic coatings were deposited on Ti-6Al-4V by means of laser cladding to protect the Ti alloy from wear loss. Microstructures and mechanical properties of the coatings deposited using various laser processing conditions were investigated. Nanoindentation and nanoscratch were used to measure the elastic modulus, hardness and wear resistance of different phases in the coatings on a nanoscale. When the applied laser energy density (LED) was relatively low (20 kJ/m), a microstructural and compositional gradient was observed across the coating thickness due to high cooling rate and an insignificant convective effect. As a result, the elastic modulus gradually increased from the coating-substrate interface to the top of the coating. When the applied LED was increased to 30 kJ/m, a uniform coating microstructure with homogenous mechanical properties across the coating thickness was obtained owing to relatively slow cooling and intense convection within the melt pool. With the increase of the applied LED, more and more base metal diffused into the coating and solidified between the large ceramic dendrites to form a composite structure. The hardness of Ti solid solution in the coatings was significantly higher than that of the base metal attributing to solution strengthening, but still lower than that of ceramic dendrites. Nanoscratch was performed on the coatings, which simulated a single asperity wear condition to study wear mechanisms of the oxide phase and base metal. And by measuring the volumes of the grooves after scratching, their wear resistance was compared. It was found that the wear resistance of the oxides was up to 10 times greater than that of the base metal.