

## **Formation of Ti–Ni intermetallic coatings on carbon tool steel by a duplex process**

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### **Abstract**

In this research, the microstructure of Ti–Ni intermetallic coatings on carbon tool steels has been evaluated. For this purpose, a layer of electroplating nickel with the thickness of 20mm was deposited on steel specimens. Subsequently, these electroplated specimens were titanized for a period of 6 h in an optimized pack cementation mixture of ferrotitanium, aluminum oxide and ammonium chloride. In order to obtain the optimum intermetallic coatings and reduce compositional and hardness profile gradients, diffusion annealing process was performed on the specimens in an argon-controlled atmosphere. Microstructural studies including optical microscopy, XRD and GDOS techniques were used in order to identify the phases which were present in the layers. Experimental results indicated that a number of Ti–Ni intermetallic compounds have been developed in the surface layers. Microhardness profiles testing were performed on the cross-section of the treated specimens in order to study the hardness gradients of the coatings. These results also indicate that diffusion annealing process of nickel-titanized surface has led to the formation of a multilayered structure, which is characterized by good adhesion of the sublayers to each other and to the substrate.

**Keywords:** Diffusion coating; Intermetallic compound coatings; Duplex process; Carbon tool steel; Ti–Ni intermetallic compounds