IIIi04-003

Study of the effect of the substrate condition on the properties of the SAE 8640 steel submitted to plasma nitriding and nitrocarburizing

Rossino, L.S.(1); Coan, K.S.(2); Antônio Junior, C.(3); Silva, F.L.F.(3); Almeida, L.S.(4); Danelon, M.R.(3); Manfrinato, M.D.(1);
(1) FATEC-So; (2) Fatec Sorocaba; (3) UFSCar Campus Sorocaba; (4) UFScar Campus Sorocaba;

Plasma nitriding (Nit) and nitrocarburizing (NC) are surface treatments that can improve the wear, corrosion, and fatigue resistance of the treated metal. The temperature and composition of the treatment environment may upgrade the surface properties of the metal but impair the properties of the substrate. The objective of this work is to verify the simultaneous effect of the nitriding temperature on the layer formation and the substrate softening, as well as the effect of NC on the effectiveness of the plasma treatment of 8640 steel. The quenching studied metal was subjected to 6 series of treatments: tempering at fixed temperature with subsequent nitriding at different temperatures (T+R450+Nit), tempering at different temperatures and subsequent nitriding at a fixed temperature (T+R+Nit450), tempering carried out together with nitriding at different temperatures (T+Nit), nitrocarburizing and tempering carried out together (T+NC) and nitrocarburizing in different temperatures in the material quenched and tempered at different temperatures (T+R450+NC and T+R+NC450). The material with and without treatment was characterized by metallography, hardness test, and abrasive microwear test. The results of the plasma treated materials were compared with the as received metal (MB), quenched and tempered (T+R), and nitrided as received material (MB+Nit). It was observed that the performance of the surface treatment generates microstructural changes and decreases the substrate hardness compared with the T+R carried out in a conventional furnace. The NC treatment is more effective in maintaining the substrate characteristics achieved in the T+R performed in a conventional furnace. The temperature of the Nit or NC treatment has a relevant influence on the hardness of the substrate, but the tempering temperature performed before the surface treatment did not show a significant influence on the surface properties of the material subjected to thermochemical treatments carried out at fixed temperature. However, the kind of processing influences the formation of the layer. For example, T+N or T+NC showed the formation of a composite layer at 250oC, which was not observed in the other processing conditions. All thermochemical treatment conditions provided higher hardness compared with MB and T+R material, emphasizing that NC produced layers with a maximum hardness, greater total thickness compared with Nit, and high wear resistance compared with MB, T+R, and Nit material, demonstrating its efficiency. Nitrided layers with porosity, high hardness, and thicker layer impaired the material wear resistance, while treatments carried out at a low temperature of 250oC reduced the wear volume of the material studied. The efficiency of the treatments carried out at low temperatures was observed, with the combination of tempering treatment and plasma treatment, and the possibility of the material uses as received in wear situations when subjected to Nit treatments.