Elaboration et Caractérisation des Revêtements durs de Molybdène et des Couches Nitrocarburées Déposés sur une Fonte Grise

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Abstract: Pearlitic gray cast iron with lamellar graphite characterized by a better wear resistance and low friction coefficient used in the majority of cases in engineering are exposed to some very demanding operating conditions, being particularly significant thermal stresses, the abrasive wear and damage by corrosion of external parts. The present study was conducted with the main objective to study the effects of two different surface treatments to improve the microstructure and there fore anti-wear properties and electrochemical of cast iron in order to minimizing a weight loss. To answer our objectives and for first phase, we have chosen a surface hardening treatment by deposition of molybdenum with a thermal flame spraying process. Considering the diversity of parameters such as the surface pretreatment, the roughness, the flame temperature ,the distance between nozzle and substrate, gas pressure, the torch speed ,we were able to obtain a deposit thickness of 780 microns and roughness about 10 microns. This molybdenum coating is characterized by a lamellar structure containing oxides types (MoO3, Mo9O26, and Mo4O11), pores and unmelted particles. However, the contribution of molybdenum with the flame-wire process led to the formation of an interdiffusion zone can form intermetallic reinforcing coating-substrate adhesion. This treatment caused an improvement in the surface hardness up to 1400 HV. This value of hardness was also confirmed by nanoindentation testing where we found the elastic properties such as Young's modulus and Poisson's ratio. Besides, this coating is characterized by improved wear resistance and corrosion in chloride medium with 3 2 g/l relatively to the substrate. In the second phase of this study, we propose a treatment salt bath ferritic nitrocarburizing at a temperature of 580°C by varying the diffusion time from 2h up to 6h. The optimal hardening was obtained at temperature 580°C for 6h. This treatment has allowed us to obtain a nitrocarburized layer composed mainly of a compound layer (?-Fe2-3N and ?'-Fe4N) followed by a diffusion layer (? and carbides). These layers a few tens microns of thicknesses have created a level of extreme hardness surface about 750 HV. Similarly, resistance to wear and corrosion in chloride solution at 32 g/l are significantly improved compared to those of the substrate.The analysis of the microstructure, mechanical, electrochemical behavior of coated systems and nitrocarburized layers were made using analysis techniques such as optical microscopy and scanning electron microscopy, grazing incidence X-rays diffraction, microanalysis of elements, Vickers microhardness, nanoindentation, testing abrasion and finally the electrochemical tests.

Keywords : traitement de surface, projection thermique, Nitrocarburation, Revêtement Mo, propriétés mécaniques, fonte grise