

Effect of annealing treatment in the mechanical property of chromium carbides films

Meryem Malla¹, Linda Aissani², Ahmed Belbah¹, Abderrezak Bezazi¹

¹University 8 May 1945, Science and Technology, Department of Mechanical Engineering, Laboratory of applied mechanics of new materials (LMANM), BP 401 Guelma 24000, Algeria.

Emails: mallameryem23@gmail.com ahmed.belbah@gmail.com ar_bezazi@yahoo.com

²Mater science department, ABBES Laghrour- Khenchela. P.O 1252, 40004, Algeria

Email: lindaaissani2004@yahoo.fr

*(mallameryem23@gmail.com) Email of the corresponding author

Abstract – Applications of thin film technology have grown quickly, including thermal insulation, cutting tools, solar cells, protection against oxidation and corrosion, and microelectronics. The use of thermoelectric thin films, which have several advantages over bulky sensors (such as sensors of: heat flow, radiation, pressure, electric power, and thermocouples), is widespread. Chromium carbides are widely attracted for industrial applications by their good hardness, high chemical stability, and toughness. The presence of carbon in the composition of chromium metal improves the hardness and the wear resistance by lubricating effect. In this work, the chromium carbides films deposited from pure Cr target by the PVD method on steel substrates are developed and characterized. In this study, the samples are annealed under vacuum in a temperature range between 800 and 1000 °C. The improvement of the mechanical property of thin Cr films is due in particular to the fact that the hardness and wear obtained in this temperature range are very important. The increase in hardness is attributed to the formation of hard binary Chromium carbides. However, its decrease was related with the diffusion of iron and the transformation of binary chromium carbides to ternary carbides at higher annealing temperatures.

Keywords – Thin films, Chromium carbides, PVD, Hardness, Annealing.