DEPOSITION AND CHARACTERIZATION OF TIN/CRN MULTILAYERS WITH NANOMETRIC BI-LAYER PERIODS

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In the last years, a big increase in the demand of PVD coatings by the industry has been produced. This is supported by important and new developments in the treatment equipments as well as in the development of new kind of layers. Looking for ultra-hard and high wear resistant coatings, PVD multilayers is one of the most promising strategies. This kind of structures let obtain surface properties which exceed totally those of conventional layers. One of the most influencing parameters in these coatings is the thickness of the individual layers. Efforts are being made in the field of the nano-layers to search quick and precise characterization methods.

Following this line of investigation and under the frame of the project NANOTRIBOCOR (Materials National Programme), PVD coatings with a multi-layered structure of alternating TiN and CrN layers have been studied. Multilayers with different bi-layer periods were deposited on high speed steel and Silicon substrates, for investigating the mechanical and tribological properties and study their correlation with the bi-layer period. The coatings were deposited by cathodic arc in a semi-industrial PVD equipment and their total thickness was about 1.5 microns, and their mechanical and tribological properties were studied.

The coatings were analysed by GD-OES, achieving quantitative in-depth profiles that could only reveal the multi-layered structure for the highest periods (Figure 1). A cold cathode FE-SEM equipment was also used for the observation of the structures. The images obtained revealed the nano-layered structures in all the cases, showing bi-layer periods in the nanometre range (Figure 2). The hardness tests showed that the coating with bi-layer periods below 12 nm presented slightly higher hardness. Considering the wear resistance, it was found that it increases as the bi-layer period decreases.

Keywords: PVD, Multilayers, Titanium, Chromium, Hardness, Wear, Friction, GDOES, FE-SEM

Figures:

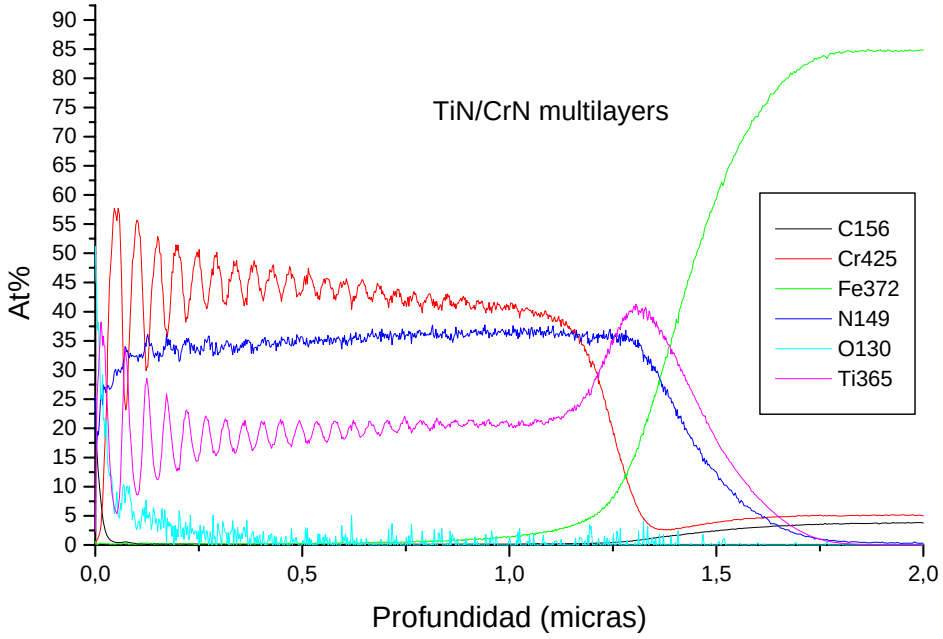

Figure 1: GDOES quantitative in-depth profile obtained for a multilayer with 48 nm bi-layer period

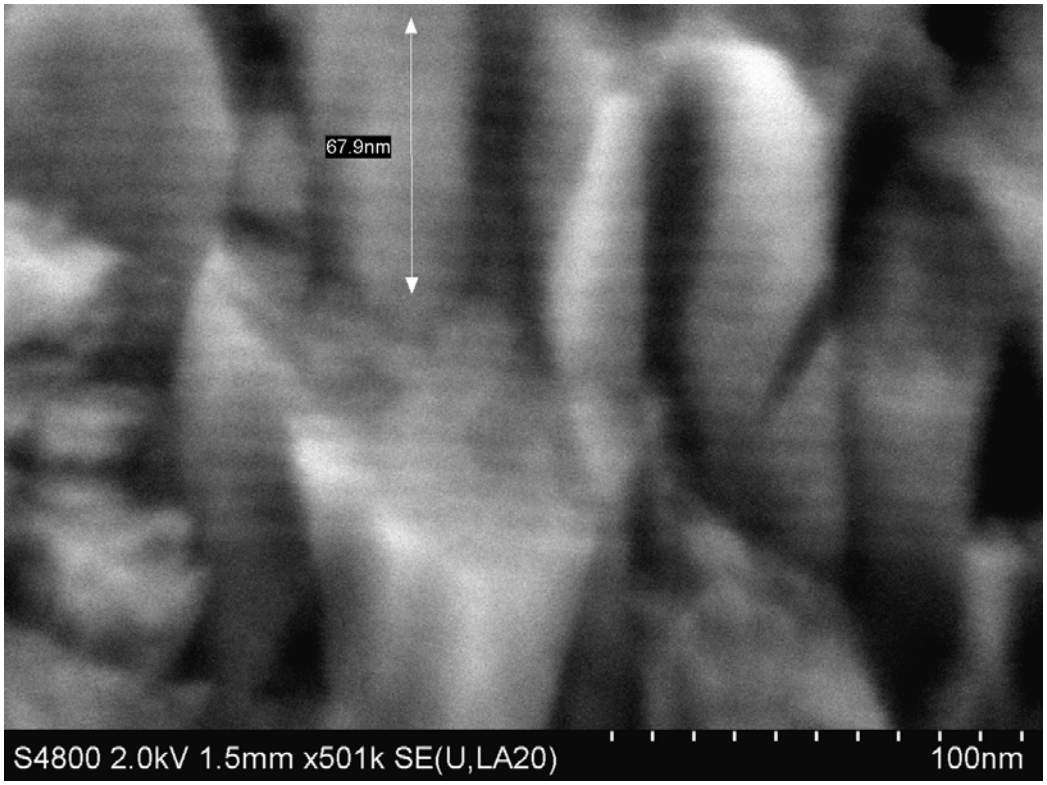

Figure 2: FE-SEM image obtained for a multilayer TiN/CrN with bilayer period under 12 nm