MICROSTRUCTURE AND HIGH TEMPERATURE MECHANICAL PROPERTIES OF HARD TaSiN COATINGS

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Hard nitride coatings are widely used in the cutting tool industry, where coatings are commonly exposed to high temperature under service conditions. The addition of Si into nitride coatings, such as the TaSiN system, has been shown to enhance their oxidation resistance [1], which coupled with its high hardness, make this system of great interest for many engineering applications involving high temperatures. In this study, the room and high temperature mechanical properties of magnetron sputtered TaSiN coatings were measured using nanoindentation (between 25°C and 500°C). Fracture toughness was also evaluated at a similar temperature range using the micro-pillar splitting method (see Figure 1). The effects of N_2 flow ratios on the composition, evolving phases and microstructure of the obtained nanocrystalline TaSiN coatings before and after the high temperature testing were examined by RBS, XRD and TEM analysis. Hardness was observed to increase with N content as we approach stoichiometries that allow higher degrees of crystallization of the TaN hard phases, which are embedded in an amorphous matrix. Coatings with an optimal composition of $Ta_{55}Si_{10}N_{35}$ retain a hardness value of up to 30 GPa at 500°C, being also the toughest.

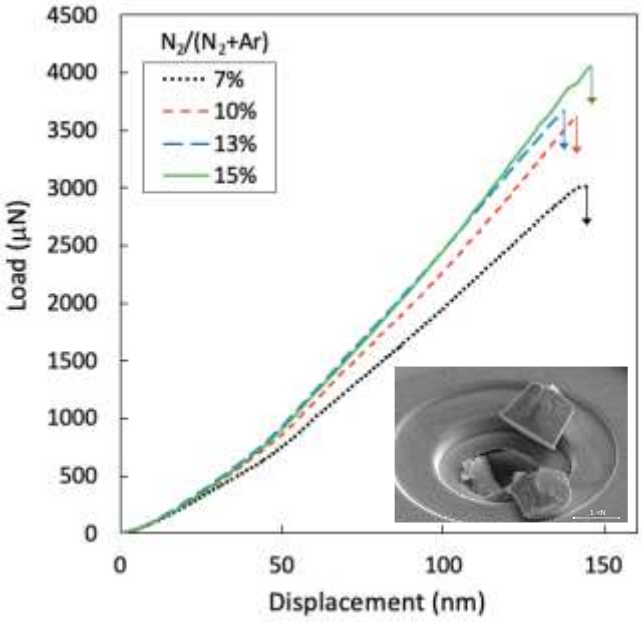

Figure 1 – Representative force-displacement curves for the TaSiN coatings showing the critical load and SEM image of the micropillars after testing

[1] Y.Chen, Y.Gao, L.Chang, Surf. Coat. Technol. 332 (2017) 72–79.