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"Results of the X-ray analysis showed reflections associated to FCC (1 1 1) crystal structure for TiCN/TiNbCN films. AFM analysis revealed a...

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★★★★☆ *Caicedo, J. C. Amaya, C. Yate, L. Gomez, M. E. Zambrano, G. Alvarado-Rivera, J. Munoz-Saldana, J. Prieto, P.*  
APPLIED SURFACE SCIENCE 2010 VOL 256; NUMBER 20, page(s) 5898-5904 Elsevier Science B.V., Amst... 2010-01-01  
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### Research from J.C. Caicedo and co-authors yields new data on applied surface science

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"Enhancement of mechanical properties by using a TiCN/TiNbCN multilayered system with different bilayer periods ( $\Lambda$ ) and bilayer numbers ( $n$ ) via magnetron sputtering technique was studied in this work. The coatings were characterized in terms of structural, chemical, morphological and mechanical properties by X-ray diffraction (XRD), atomic force microscopy (AFM), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and nanoindentation," scientists in Cali, Colombia report (see also Applied Surface Science).

"Results of the X-ray analysis showed reflections associated to FCC (1 1 1) crystal structure for TiCN/TiNbCN films. AFM analysis revealed a reduction of grain size and roughness when the bilayer number is increased and the bilayer period is decreased. Finally, enhancement of mechanical properties was determined via nanoindentation measurements. The best behavior was obtained when the bilayer period ( $\Lambda$ ) was 15 nm ( $n = 200$ ), yielding the highest hardness (42 GPa) and elastic modulus (408 GPa). The values for the hardness and elastic modulus are 1.6 and 1.3 times greater than the coating with  $n = 1$ , respectively. The enhancement effects in multilayer coatings could be attributed to different mechanisms for layer formation with nanometric thickness due to the Hall-Petch effect; because this effect, originally used to explain the increase in hardness with decreasing grain size in bulk polycrystalline metals, has also been used to explain hardness enhancements in multilayers taking into account the thickness reduction at individual single layers that make the multilayered system," wrote J.C. Caicedo and colleagues.

Caicedo and colleagues published their study in *Applied Surface Science* (TiCN/TiNbCN multilayer coatings with enhanced mechanical properties. *Applied Surface Science*, 2010;256(20):5898-5904).

For additional information, contact J.C. Caicedo, University of Valle, Thin Film Group, Cali, Colombia.

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TiCN/TiNbCN multilayer coatings with enhanced mechanical properties

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Résumé / Abstract

Enhancement of mechanical properties by using a TiCN/TiNbCN multilayered system with different bilayer periods (A ) and bilayer

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