Application Note: TiAlN coating for dies

Overview

TiAlN is used as a protective overcoat for dies and other tools in the automotive industry.

The Young's modulus and hardness of an industrial TiAlN coating were measured by standard nanoindentation (N = 32) as:

- E = 382 ± 17.5 GPa
- H = 25.0 ± 1.5 GPa
- HV = 2365 ± 139 kg/mm^2

Applied Nanometrix offers nanoindentation testing using instruments that undergo quarterly verification and daily checks for assured accuracy.

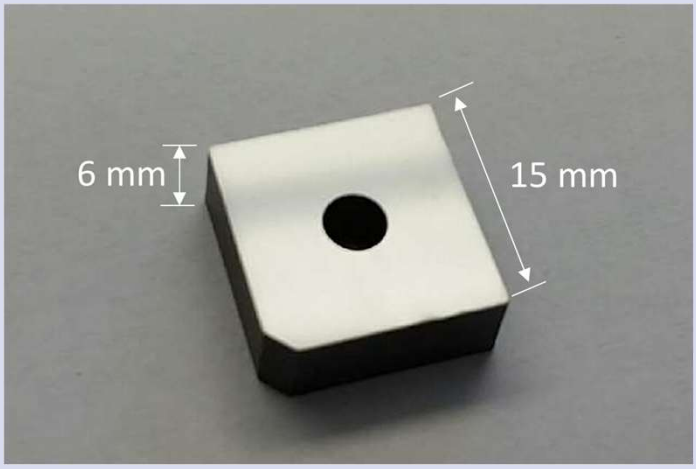

Figure 1. Witness coupon for evaluation of 4um TiAlN coating on tungsten-carbide substrate.

Procedure & Analysis

Arc-ion plating was used to deposit a 4 μm coating of titanium-aluminum-nitride (TiAlN) on a witness coupon of tungsten-carbide (WC). The coupon was mounted on an aluminum stub (1.24" diameter) for nanoindentation.

Thirty-two (32) indentations were performed to a peak load of 100mN in accordance with ISO 14577-1. The testing load of 100mN caused an indentation depth of about 500nm. Individual indentations were separated by 30um.

Per ISO 14577-1, Vickers hardness (HV) was calculated as a constant multiple of the nanoindentation hardness (HV = 94.5*H_{IT}).

Significance

Witness coupons are included at various locations in deposition chambers to allow routine analysis of coating quality. Nanoindentation allows rapid analysis of the Young's modulus and hardness of the witness coupon which ensures the quality of all coated parts.

Nanoindentation is a better way to measure the Vickers hardness of a coating, because it doesn't require any imaging of the residual impression. With nanoindentation, the contact area is inferred from the load and depth measurements acquired during the indentation process.

Getting started

To discuss nanoindentation testing of your materials, contact Jennifer Hay at Applied Nanometrix at 865-804-9721 or Jennifer@appliednanometrix.net.