Micro Materials
Excellence in Nanomechanics

MicroTest 20N high load head

MicroTest module with the NanoTest Vantage

Adding the MicroTest (20 N) module to your NanoTest greatly expands the capability of the system to cover both nano- and micro-ranges. By having both loading mechanisms permanently mounted the range of possible tests is increased. The module has proved a popular addition at MIT and The University of Cambridge. Materials commonly tested including cemented carbides, metals, shape memory alloys and hard coatings.

How it works

The MicroTest loading mechanism has been engineered to sit alongside the NanoTest loading mechanism and thus avoids the requirement for physical hardware exchange. The module retains the excellent stability, the wide range of test techniques of the NanoTest Vantage – the most comprehensive nanomechanical testing centre available.

The MicroTest (0 – 20 N) load range is suitable for:

- Micro-Indentation
- Micro-Impact & Fatigue
- Micro-Scratch & Wear

- These tests can be done at high temperature (max 750 ^{0}C or in inert environments.
- A microscope can be used for precise positioning of indentations.

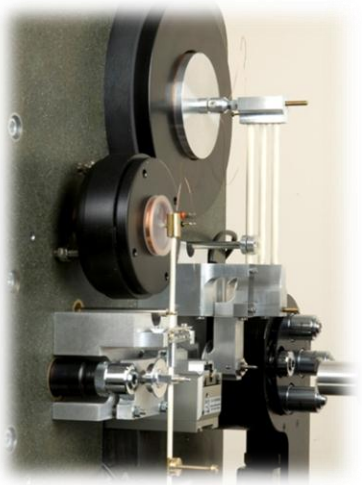

Figure 1 *– The nano and micro loading mechanisms*

Micro-Indentation of cemented carbides

Knowledge of both hardness and toughness combined is required to assess for performance under severe mechanical loading. Even subtle changes to the % binder and carbide grain size in cemented carbides can have a dramatic influence on tool life. It is the sub-surface mechanical properties that control the fatigue performance in applications such as high performance stamping. Below, micro-indentation has been used to determine the mechanical properties of different cemented carbides.

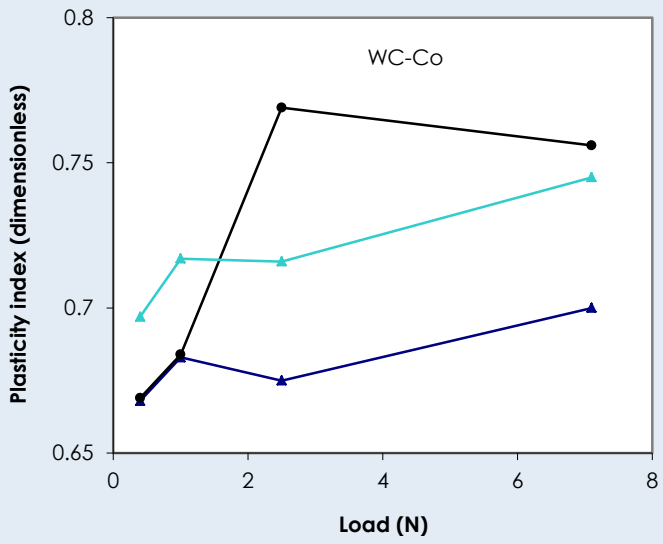

Figure 2 shows the variation in plasticity index with load for three commercial grades of WC-Co. Plasticity index = plastic work/total work. Even small changes can dramatically influence tool life.

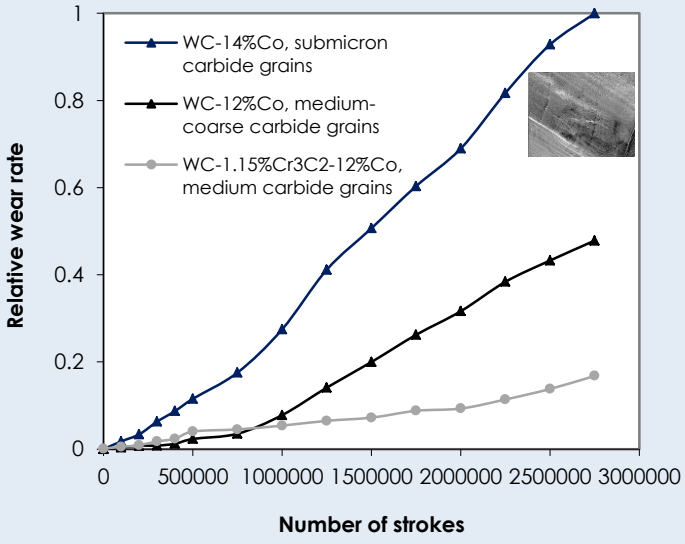

Figure 3 shows the high load stamping wear of WC-Co tools. There is a direct correlation between the Micro-Indentation data (Figure 2) and the tool life. The WC-Co with the lowest plasticity index has greater tool wear due to brittle cracking.

NanoTest Vantage

Micro Scratch & Wear

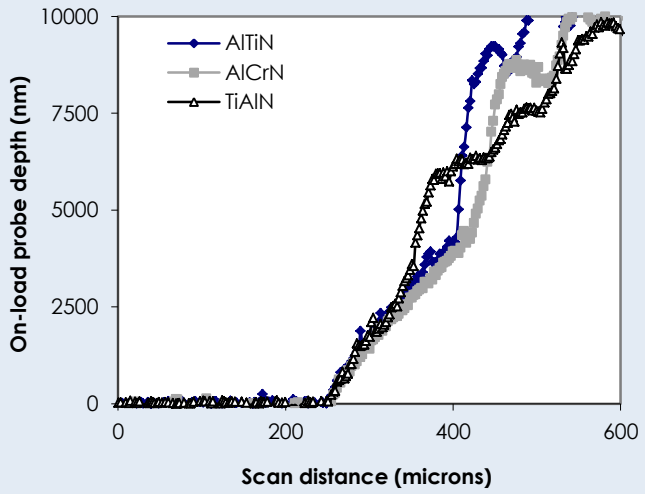

Figure 4 shows ramped load scratches of 2.5 µm on AlTiN, AlCrN and TiAlN PVD hard coatings with a 25 µm scratch probe. All show complete coating failure well before the peak load is reached, with the TiAlN failing at the lowest load, consistent with its poorer performance in cutting tests.

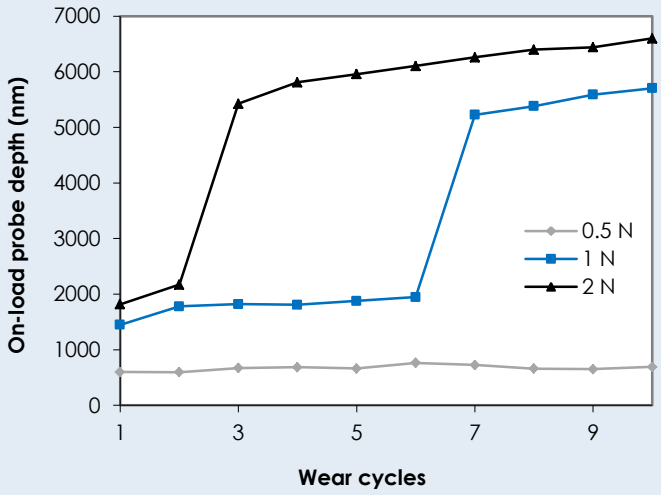

Figure 5 shows10-cycle repetitive constant load scratch tests at 0.5-2 N on 2.5 µm AlTiN coated WC-Co. At the lowest load the coating does not fail during the 10 cycle test but as the load is increased failure occurs after a smaller number of cycles. Abrupt film failure (delamination) occurs during cycle 7 at 1N and during cycle 3 at 2 N. On-load wear depths can be determined during the test allowing the evolution of damage to be followed.

- **MicroTest module allows the application of loads up to 20N**
- **Excellent stability, load and depth resolutions on separate loading head**
- **Positioned next to the NanoTest loading mechanism meaning no physical hardware exchange**
- **Compatible with the other test techniques of the NanoTest Vantage**

Micro Impact & Fatigue

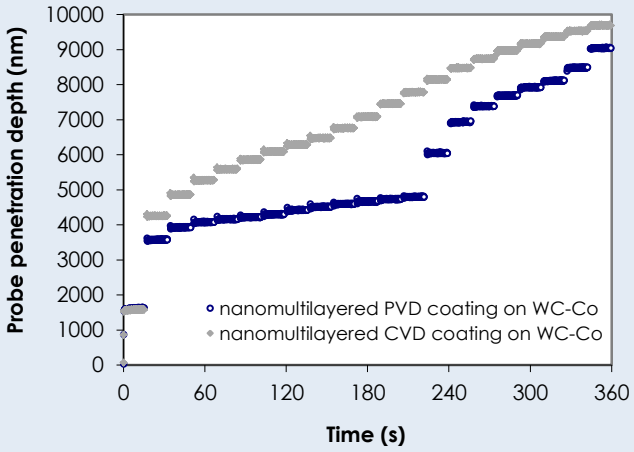

Figure 6 shows the differences in impact resistance of 7 µm thick nanomultilayered coatings used for high speed machining. An impact force of 1 N was required to fail these thick coatings rapidly. The test shows clear differences in the evolution of impact damage that correlate with tool life. *Data courtesy CEROC/Polytech Tours.*

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