

## Workshop »Coatings for Tools & Components«

### Plasma Etching Where it Matters, Dedicated to the Cutting Tool Geometry

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Wear-resistant hard coatings and cutting-edge preparation took over key roles in the optimizations of precision tools. In addition to the correct selection of the micro tool geometry, the hard coating must also be adapted to suit the application [1]. The best protective hard coating system could not show its full potential without fulfilling the basic requirement: Sufficient adhesion to the substrate material. Prior to the thin film deposition, the substrate material must be free from any impurities on the atomic scale. This can be achieved in high-vacuum PVD systems with glow discharge techniques igniting a plasma directly on the substrates and carousel at several hundred volts prior to the PVD and/or PECVD process [2].

With this contribution, we would like to introduce our patented 3D plasma etch indicator, which is considered as a breakthrough in plasma etching profile measurement. This new approach provides a 3D visual profile of the plasma etching efficiency over several tens of centimeters of the surface of any shape with the ability to tailor a dedicated etch profile to industrial parts of interest.

To obtain such a 3D etch profile, the studied samples (e.g., cutting tools) were covered with thin films reflecting homogeneously a single interference color (e.g., blue). These samples were then placed into the coating chamber and the plasma etching procedure was carried out for a defined time. After plasma etching, the thin interference layer on the sample surface decreased unevenly in terms of thickness. Since thin film interference color corresponds directly to its thickness, the resulting color at any point of the surface provides the information on the etching efficiency at that particular point with a resolution of 5 to 10 nanometer.

As a result, the 3D plasma etch indicator provides a tool for selecting the right combination of etch parameters and provides dedicated etching processes adapted to the geometries to be coated. This could have never been verified and adjusted across the PVD industry, even though the community is aware that the etching process for shank tools should be different than a gear cutting tool or a segmented die. In this way, 3D etch profiling can be used to ensure that the selected etching strategy leads to 100% treatment of the sample surface with complex 3D geometry.

Literature:

[1] Luemkemann A., et al. Schneidkantenpräparation und Beschichtung. XIII. Internationales Oberflächenkolloquium, Chemnitz (2012).

[2] Mattox D. M. Handbook of physical vapor deposition (PVD) processing. William Andrew, 2010. Chapter 13.11.2 – Sputter Cleaning