

PO3065

## **Applicability of hydrogen containing amorphous DLC for forging applications**

René Weirauch<sup>1</sup>, Hanno Paschke<sup>2</sup>, Günter Bräuer<sup>1</sup>, Peter Kaestner<sup>1</sup>, Jochen Brand<sup>2</sup>

<sup>1</sup>TU Braunschweig/IOT, Braunschweig, Germany <sup>2</sup>Fraunhofer Institut für Schicht- und Oberflächentechnik, Braunschweig, Germany

rene.weirauch@ist.fraunhofer.de

Diamond-like carbon coatings (a-C:H) offer very interesting tribological properties especially in reducing the friction coefficient in addition to wear and adhesion reduction. Although at temperatures higher than 300 °C the usability is reduced because of degradation of the coatings due to graphitization and oxidation effects. Doping with several elements like tungsten, vanadium or chromium stabilizes a-C:H above this temperature range.

Typical a-C:H: Me-films (Me: Cr, Ti, W, V) were prepared by d.c. magnetron sputtering and investigated on their application at temperatures higher than 300 °C. To identify the film characteristics at higher temperatures, samples were tempered in argon at atmospheric pressure at 450 and 550 °C for 1,5 to 6,0 hours. 1,2343 steel was used as the substrate. The results were compared with the hard coating CrN and with the metal free a-C:H-film. In addition the a-C:H: Me-films metal content was varied.

For the practice investigations were made with a screw press (press capacity 11,000kN). For this purpose forging tool inlays were coated with carbon films (metal containing and metal free) and with every coated forging tool 100 forming tests were made. Before forging the forging samples were preheated to 750 °C. After the first forging tests different analyses (roughness, adhesion) shows the best tribology behavior at a-C:H:Cr (high metal content) and metal free a-C:H. For this reason these films were chosen for a small series forging process with 1,000 forming tests. To compare the films, an uncoated forging tool was also used. The temperature of forging samples was also 750°C. After forging, the tools with a carbon film showed a very good surface structure in comparison to the uncoated forging tool.

This study confirms that a-C:H:Me, because of their better temperature stability, definitely present a good option for typical hard films such as CrN and should be suitable for forging applications.

### **Keywords**

Diamond like carbon; DLC; Me-DLC  
forging applications