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Deposition of thick a-C:H:Si-films in an industrial DC-PACVD-systemDaniel Heim¹, Christian Forsich¹, Thomas Müller², Andreas Gebeshuber²¹Upper Austria Univ. of Applied Sciences, Wels, Austria ²Rübig GmbH&Co KG, Wels, Austria

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DLC films are meanwhile used in a wide range of applications. Constrains for many further applications are the limited mechanical carrying capacity of thin DLC-films and adhesion problems, especially on "softer" substrates e.g. steels used in mechanical engineering. In most applications DLC-films are deposited on polished or smooth surfaces and not on "rough" surfaces as they are often found in technical praxis.

a-C:H:Si films were deposited in a pulsed DC-PACVD-system at temperature and pressure ranges normally used for plasma nitriding with film thicknesses up to 50µm. HMDSO was used as Si-precursor in mixtures with Ar, H₂ and C₂H₂ as process gases. Samples with different initial surface roughness (polished to grinded) were coated with films of different thicknesses. To test the homogeneity of the resulting films within the system, samples were put at different positions in the chamber at high loading of the system.

The evolution of the resulting DLC-surfaces with increasing film thickness was investigated by confocal microscopy and SEM. The chemical compositions of the films were analyzed by GDOES and EDX. Adhesion of the resulting films were tested by scratch tests and Rockwell indentation tests and hardness by nano indentation. The tribological behaviour of the resulting surfaces was investigated by a pin-on-disc tribometer.

Although the resulting films are highly electrically insulating the plasma process is very stable up to these high film thicknesses. The resulting DLC-films show hardnesses up to 2000HV and friction coefficients down to 0.05. The scratch tests demonstrate that the adhesion of the films can be remarkable increased with the film thickness with critical loads up to 85N. The pin-on-disk tests on the thick coated rough surfaces show very promising results for technical use.

Keywords

DLC

PACVD

pulsed dc

thick films

a-C:H:Si