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## **Effect of the degree of HIPIMS utilisation on the properties of TiN films**

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TiN films were deposited using HIPIMS enabled four cathode HTC 1000-4 Hauzer coating system equipped with Huettinger Electronic Sp.z.o.o. HIPIMS power supplies. The standard version of this system allows control over the ion bombardment during coating growth by varying the strength of the electromagnetic field of the unbalancing coils as well as the bias voltage applied to the substrate. The coatings were produced in different coating growth conditions achieved in a mixed High Power Impulse Magnetron Sputtering-Unbalanced Magnetron Sputtering (HIPIMS-UBM) process where HIPIMS was used as an additional new tool to manipulate the ionisation degree in the plasma. The degree of HIPIMS utilisation in this study was varied from 0%-100% with increments of 25%. TiN coatings phase composition, microstructure as well as properties such as residual stress, microhardness and tribological properties were studied by number of surface analyses techniques such as XRD, XSEM, XTEM as well as nanoindentation and pin-on-disk tests. It was revealed that in mixed HIPIMS-UBM processes performed in a specialised multiple cathode coating system, the residual stress can be controlled in wide range from -0.21GPa to -11.35 GPa by intelligent selection of the degree of HIPIMS utilisation, strength of the electromagnetic field of the unbalancing coils as well as the bias voltage applied to the substrate while maintaining coatings stoichiometry. The effect of the above mentioned way of plasma manipulation on the structure, mechanical and tribological parameters is discussed. Mixing HIPIMS with UBM is also seen as an effective tool for improving the productivity of the deposition process.

### **Keywords**

HIPIMS

TiN

unbalanced magnetron sputtering

structure

stress