HiPIMS Deposition of metal and Oxide Coatings

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Deposition of thin films via High Power Impulse Magnetron Sputtering (HiPIMS) has shown important advantages over conventional DC and mid-frequency pulsed-DC magnetron sputtering. High ionisation fractions of the target material have been observed, along with low thermal energy flux delivered to the substrate and the formation of high quality coating structures. These benefits have, however, been offset by certain disadvantages - in particular low rates of deposition, and problems with process control during reactive sputtering - which have inhibited the rate of commercial uptake of the technique.

Characterisation studies of HiPIMS deposition of metal films are presented to demonstrate the effects on the thermal energy of the depositing flux, and the nature of the plasma potential in this mode of operation, along with its influence on film properties. In addition, investigations into the reactive deposition of oxide coatings are discussed to provide insights into hysteresis and its effect on process control. Techniques including partial pressure control, plasma emissions and target voltage monitoring have been evaluated and compared. Coatings grown via reactive HiPIMS deposition have been analysed in terms of a number of properties for comparison with conventional sputtering techniques, such as DC and mid-frequency pulsed-DC magnetron sputtering.