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# HiPIMS meets Diamond

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This paper will introduce a visionary new class of coating materials with revolutionary properties. It creates added value by merging diamond – the hardest of all materials – with HiPIMS – smooth and dense sputtered films – into one new material.

The starting point of HiPIMS meets Diamond was the search for new coatings for high gloss mirror finish machining with micro-cuttings tools for the 3C industry (Computers, Consumer Electronics & Communications). The extreme requirements set by this industry brought up a new approach of tuning the "knobs" of HiPIMS for novel plasma regimes during etching and the deposition phase. This involves new hardware features as individual parameter sets for all HiPIMS sources while keeping the synchronization to the dedicated HiPIMS bias. Application cases will show that the plasma synchronization is the key to minimize intrinsic stress while having a deposition rate as high as 2µm/h at the same time.

This new way of controlling the pulsed HiPIMS plasma made possible the design of HiPIMS meets Diamond. The exceptionally hard diamond provides the perfect foundation to the HiPIMS film. Furthermore, diamond has an outstanding thermal conductivity and spreads the extreme heat coming from the cutting zone. The smooth, droplet-free surface of HiPIMS coatings reduces friction, protects the diamond against oxidation and optimizes the running in process of the cutting tool. All this makes HiPIMS meets Diamond the perfect candidate for coatings for heatresistant superalloys.

Case studies as the machining of casted CrCo for medical implants and the milling of stacks with extra thick titanium layers show that the radically new materials concept HiPIMS meets Diamond paves the way for new business for cutting tools after the combustion engine.

**Keywords**
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