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12 μm PVD in HiPIMS

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Coating development focussed for decades on the film's composition in an endless endeavour for increasing the hardness of the coating. On the other hand it was taken for granted that the thickness of tool coatings is limited to 3-4 μm . More than 6 μm is for traditional technologies not a viable option due to excessive intrinsic stress. No real improvement are the usual workarounds such as bond coats and multilayers with soft intermediate layers. The process gets slower and more prone to failures. There was no technology available to deposit the extra thick coatings for heavy-duty metal cutting applications. This paper will shine a light on a new direction for protective coatings: managing intrinsic stress and a dense morphology of the film.

HiPIMS is a good candidate since it is known for a dense structure without any droplets resulting in toughness and hardness at the same time. The real innovative leap is stress management by synchronising the HiPIMS pulses on the cathodes with the substrate bias. This paper will introduce the concept of selective ion biasing. Plasma analytics reveal that the flux arriving at the substrate per HiPIMS pulse is composed of the wanted metal ions coming from the target and other ion portions which highly influence the intrinsic stress of the growing film. Selective ion biasing is a fully new tool and allows to precisely select certain ion portions out of the pulse while suppressing unwanted species. Now the coating developer can actively tune the intrinsic stress of the film by setting the synchronisation parameters.

Full control on the process, the morphology and the intrinsic stress growing film – that's the quantum leap of selective ion biasing. And this for different HiPIMS frequencies and pulse data for each and every cathode – tailored for the respective target material.

A case study of FerroCon®Quadro as a 12 μm PVD coating illustrates how HiPIMS moves the frontiers of the possible in tool coatings. Applications such as the milling of crank shafts, railway tracks and heavy duty turning show the enormous performance benefit of very thick PVD coatings for cutting tools. 12 μm PVD work, in HiPIMS.

Keywords

HiPIMS

thick

stress management

dense