

# Ion Enhanced EB PVD Process for Coatings

Igor Belousov

Pratt and Whitney Paton, Kiev Ukraine

ibelousov@pwpaton.com

Widely used high rate electron beam physical vapor deposition (EB PVD) process has a number of limitations/disadvantages like low coating adhesion, existence of droplets in vapor flux, coating porosity/defects, limitations for alloy deposition containing components with large difference of vapor pressure.

Modified method for the coating deposition based on ion-plasma processes (Ion Enhanced EB PVD) is free from the above disadvantages to a large extent. This method extends the technological possibility for coating process.

Such particularities of the IE EB PVD as a presence of ions in a vapor cloud and the possibility of ion bombardment of substrate surface and growing layer allows controlling the layer properties.

The ion bombardment results in cleaning, smoothing relief of the substrate surface and increases of the surface temperature. As a result the coating adhesion noticeably increases.

The ion bombardment of the condensation surface densifies the coating, “heals” the surface relief features like scratches, pits, droplets of evaporating material that enhances mechanical properties of the coating.

Spitting phenomenon peculiar to conventional EB PVD method is partially solved by using IE EB PVD process. Number and size of droplets that reach the substrate surface are reduced due to its interaction with plasma.

Usage of IE EB PVD together with sputtering of additional target by ions extracted from the plasma allows doping of a coating by the target material.

Variation of IE EB PVD process parameters allows formation of a coating with layered structure and/or composition.

Equipment for the IE EB PVD was fabricated and the above advantages of the process were demonstrated for metal alloys (Ti-based, MCrAlY) and ceramic (YSZ) coatings.