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Modification of PVD Coatings to Cover Surface Imperfections

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From the technological and economic point of view it is desirable to reduce the influence of defects on substrate material surface on coating and - hence - component performance. Defects in technical component surfaces influence the proceeding film nucleation significantly and hence determine the development of the coatings microstructure. As a consequence the subsequent functional properties of the coatings are affected.
The aim of this work is to quantitatively determine the covering ability of PVD thin coatings in regard to the process parameter depending microstructure. It is known that the microstructure of PVD coatings for example depend on the process parameters such as the process gas composition and the bias voltage. Within this work CrN thin coatings with different specific microstructures due to PVD process parameter variations and additional usage of HiPIMS were deposited on various substrate materials and thoroughly characterized. Specific geometric profiles are placed in the samples surface and the profiles are measured before and after deposition processes using a µ-surf 3D surface profilometer. Based on this data a grading coefficient is calculated and the covering abilities of different thin coatings are compared. Before the deposition the substrate surfaces were prepared with Vickers indentations. Those indentations have a defined geometry and thus serve as a model for surface defects.
Based on the achieved profile image data, both the depth profile of the coated Vickers indents and the two diagonals of this specific Vickers geometry can be quantified. The resolved data allows determining the residual volume of the coated Vickers indentations. The difference between the Vickers volume before and after deposition is used as a quantitative degree of coverage. The developed method allows differentiating the ability of different coatings microstructures to cover surface imperfections.

Keywords
PVD
Microstructure
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