Residual stress analysis in chromium nitride as a function of coating conditions and post-treatments

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Development of modern PVD hard coatings often focuses on creating new properties by finding new material combinations and deposition conditions. In this approach it is tried to understand more deeply how coating properties such as Young’s modulus, coating hardness, and mechanical residual stress depend on the coating conditions. A special focus is laid on the characterisation and quantification of residual stresses and its applicability as a coating design tool. As model material chromium nitride (CrN) was chosen, a well-known hard coating that grows in a simple cubic crystal lattice. It was deposited by PVD arc evaporation on steel substrates using a commercially available coating system. Bulk residual stresses and near-surface stress depth profiles were analysed with X-ray diffraction (XRD). The stress depth profiles revealed that depending on the bias voltage and gas pressure, the internal stresses increase, are constant or even decrease towards the outermost surface. It is shown that the influence of post-treatments like micro-blasting and wet blasting mainly increase the stress in the stress depth profile, but do not change its trend.

Keywords
Hard Coatings
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