

Numerical and experimental study of PVD film growth in an industrial chamber

B. Nano-engineered coatings and thin films: from design to applications

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Abstract

The POLARISS project (ANR-22-CE08-0021) aims to develop the next generation of cutting tools for cryogenic machining processes (milling, turning, drilling). These tools, often of complex geometry, are mounted on a carousel substrate holder that can operate in static mode, with single rotation, or with dual rotation. The samples are positioned at different heights on the carrier bars. Under identical process conditions (*i.e.*, constant temperature, bias voltage, target power, and working pressure), the deposited films may still display different behaviors, sometimes falling outside the expected property ranges.

This work investigates, both experimentally and numerically, the evolution of chromium film properties as a function of position inside the chamber and of the carousel rotation modes. The control parameters to be studied include film thickness, morphology (surface and cross-section), composition (with particular attention to oxygen incorporation as a contaminant), residual stress, and structure.

In the static case, Simtra and Virtual Coater are used to study material fluxes and film growth. For the rotating cases (single and dual rotation), only Virtual Coater is employed. Numerical and experimental results will be systematically compared.