

PO3018

**Optimization of CrAlN PVD Coatings for Dry Machining by FEM Simulation**Casper Pusch<sup>1</sup>, Holger Hoche<sup>1</sup>, Sascha Beblein<sup>2</sup>, Bernd Breidenstein<sup>2</sup>, Matthias Oechsner<sup>1</sup><sup>1</sup>Center for Engineering Materials, TU-DA, Darmstadt, Germany <sup>2</sup>IFW, Leibniz Universität Hannover, Garbsen, Germany

pusch@mpa-ifw.tu-darmstadt.de

The conventional development of a coating system for cutting inserts includes a variety of test series with elaborate experimental parameter studies. In particular, conventional investigations of the cutting behavior by trial and error cause a considerable consumption of time, resources and costs. Therefore, it is desirable to reduce the effort for the development significantly by using simulations of the cutting process to adapt the coating properties to the requirements of the specific cutting task.

Based on 2D FEM simulations using Deform 2D of the dry cutting process of 42CrMo4 steel by CrAlN-coated WC-Co cutting inserts, the deposition parameters were adjusted to improve the cutting behavior. CrAlN coatings with optimized as well as non-optimized properties were deposited onto WC cutting inserts. The coatings were deposited by reactive magnetron sputtering using an industrial PVD magnetron sputter unit CemeCon CC800/9. The coatings chemical composition was varied by variable target configuration using segmented targets of chromium and aluminum segments. The dry cutting performance of the coated inserts was experimentally tested with an orthogonal cutting process of 42CrMo4 steel without cooling and the results of the simulations were compared with the experiment. Furthermore, ball on disk wear tests were conducted by reciprocal dry sliding tests by using a SRV 3 tribometer. The results of the wear tests were compared with the results of the cutting test.

It will be shown that the thermal conductivity of the coating, the hardness and the friction coefficient significantly influence the machining performance. The optimized coating exhibits a higher lifetime compared to the non-optimized coatings. The SRV wear test shows an opposite result compared to the results of the cutting test.

**Keywords**

CrAlN

PVD

Cutting Simulation

Cutting Test

SRV wear test