PO2036

High speed gear hobbing with customized AlCrBN coatings

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In 2017 the automobile production and therefore also the transmission production exceeded 90 million. With automobile gearboxes containing 20 or more single gears, this adds up to nearly two billon manufactured gears per year, alone in this industry sector. Further advancing fields of high performance gear application are aero-engines and wind turbines. Regarding green manufacturing gear hobbing processes are applied most often in these kinds of larger batch productions. Within this process, cutting conditions regarding chip thickness and cutting length change continuously with every generated chip. Hence, the load on the cutting edge varies critically too and affects abrasive and crater wear on the tool. Dry cutting is state of the art in gear hobbing. This intensifies the thermal process load and thus the wear phenomena.
To examine the performance of different coatings, cutting tests were performed using the well-established fly-cutting analogy test. Subsequently the worn out single hob teeth were examined by REM and confocal 3D microscope to evaluate the wear phenomena.
To reduce crater wear and to extend the performance of gear hobs a range of AlCr-based coatings were deposited in industrial π411 and π1511 arc sputtering PVD units. Significant performance differences between the chemically and structurally modified coatings were found. The addition of Boron into AlCr-based layer enables the reduction of internal stress of the coating system. Furthermore an substantial increase of tool life was achieved by doping the coating top layer with titanium in combination with an optimized nanolayer structure.

Keywords
gear hobbing
coating development
PVD
AlCrBN
arc evaporation