Innovative Cutting Tools for Machining Powertrain Materials

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Abstract

Advanced Powertrain materials like CGI (Compacted Graphite Iron) and ADI (Austempered Ductile Iron) are gaining more and more importance. Their mechanical properties contribute to save weight and gain performance in automotive engines. Implementing these materials allows to realize higher injection pressures and therefore a reduction of pollutant emission. However these mechanical properties reduce tool life considerably. Because of the following higher production costs (compared with conventional materials) CGI and ADI are presently used mainly on upper class cars and trucks. To bring this technology in the mass-market an economical manufacturing is a precondition. A particular challenge for the cutting tools is the high abrasiveness of these heavy-duty materials. The demand for the highest productivity, cost efficient machining and reliability of the fabrication process requires the mobilization of all available resources. Besides the selection of cutting material and coating special attention was set on point geometry and flute design. Modern methods like modeling and simulation support the tool development and lead to success with a higher accuracy in a shorter time. Also investigations were done in the field of different cooling lubricants like conventional emulsions cooling and environmentally friendly MQL (Minimum Quantity Lubrication). In laboratory tests with real-time thermal imaging, high-speed imaging, recording of cutting force and evaluation of the produced work piece (geometry, surface and chip formation) suitable machining data (cutting speed, feed rate) were determined. Finally the adaptation into the production chain completes the development.