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Experimental Evaluation of Innovative Tools for Ti-6Al-4V Turning

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Titanium alloys, mainly because of their poor thermal conductivity, need to be cut at relatively low cutting speeds, with obvious negative consequences on the profitability of machining. An important amount of research activities has been done in order to increase productivity in titanium machining operations: high performance coatings and innovative technologies to improve inserts resistance to wear represent promising solutions.
In this work, the cutting performance of an innovative TiAlN coating obtained by Physical Vapor Deposition (PVD) magnetron sputtering and the effects of a Deep Cryogenic Treatment (DCT) have been experimentally investigated and a statistical analysis of results has been performed. Typical commercially available inserts (TiAlN-AlCrO coated) have been used as a benchmark. The experiments have been designed in order to estimate the tool life and other variables of interest with different process parameters. The results show that even if friction coefficients are lower for standard tools, innovative inserts exhibit a higher resistance to wear. Taylor's law parameters of PVD coated tools, with and without DCT, have been determined and they clearly show that cryogenically treated tools present higher resistance at higher cutting speeds, mainly due to their superior hardness. This result indicates that cryogenic inserts could have important applications for high rate machining of titanium

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