Influence of Coolant Flow on Tool Wear under Jet Cooling Conditions

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Abstract. The control of the coolant flow has a direct influence on the tool life or cutting performance in high speed machining of difficult-to-machine materials. In this paper, the coolant jet was applied to the tool tip from a small size nozzle on the side of flank face during turning and coolant flow was changed by making a groove on the tool flank face. Triangular types of grooves with different groove depths were made on the tool flank face. These groove were designed for reducing the flank wear near the depth-of-cut line. The work material was type 304 stainless steel and the tool used was a cemented carbide insert of M35 grade with a single coating layer of titanium composite. A high cutting speed of 300 m/min was selected and the coolant pressure was 0.3 MPa. It was found that coolant jet was much better in reducing tool wear than flood coolant. Combination of a triangular groove and coolant jet was very effective in reducing tool wear. There was the optimum distance from the depth-of-cut line to a groove. However, groove depth had neither positive nor negative effects in wear reduction. Finally, the computational fluid dynamic analysis of coolant flow was conducted for three inserts with triangular type grooves. Particleworks, one of codes for smoothed particle hydrodynamics was used for the analyses. It was not easy to indicate a definite relationship between the flank wear and parameters of flow of coolant.