

Evaluation of machining performance of MMC with PCBN and PCD tools

Abstract

This paper reports on experiments carried out to study the performance of various type of polycrystalline cubic boron nitride (PCBN) and polycrystalline diamond (PCD) cutting tools during machining of aluminium alloy reinforced by silicon carbide metal matrix composite (Al-SiC MMC). While different wear modes were observed on the surfaces of the cutting tools, the surface finish was found to be governed by the notch wear formed on the flank face and the transfer of work material onto the workpiece. During machining, the PCBN tools were subjected to intergranular fracture, and the amount of work material adhering onto the tool and the workpiece increased significantly with cutting speed. While it was found that the use of coolant could result in a marked reduction in the amount of work material on the machined workpieces, it could also cause an increase in the severity of abrasion between the flank face and the machined surface. This in turn led to an increase in notch wear and thus a deterioration of the surface finish. These detrimental effects were more pronounced at low cutting speed using a fine-grained and binderless PCBN tool. PCD tools exhibited better performance than PCBN tools because they possessed higher abrasion and fracture resistance, and lower adhesion property with the work material.