**Study of Chip Morphology and Chip Formation Mechanism During Machining of Magnesium-Based Metal Matrix Composites**

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**Abstract:**

Magnesium (Mg) and its alloys are among the lightest metallic structural materials, making them very attractive for use in the aerospace and automotive industries. Recently, Mg has been used in metal matrix composites (MMCs), demonstrating significant improvements in mechanical performance. However, the machinability of Mg-based MMCs is still largely elusive. In this study, Mg-based MMCs are machined using a wide range of cutting speeds in order to elucidate both the chip morphology and chip formation mechanism. Cutting speed is found to have the most significant influence on both the chip morphology and chip formation mechanism, with the propensity of discontinuous, particle-type chip formation increasing as the cutting speed increases. Saw-tooth chips are found to be the primary chip morphology at low cutting speeds (lower than 0.5 m/s), while discontinuous, particle-type chips prevail at high cutting speeds (higher than 1.0 m/s). Using in situ high-speed imaging, the formation of the saw-tooth chip morphology is found to be due to crack initiation at the free surface. However, as the cutting speed (and strain rate) increases, the formation of the discontinuous, particle-type chip morphology is found to be due to crack initiation at the tool tip. In addition, the influences of tool rake angle, particle size, and particle volume fracture are investigated and found to have little effect on the chip morphology and chip formation mechanism.