

Machinability of nickel-titanium shape memory alloys under dry and chilled air cutting conditions

Abstract

Nickel-titanium (NiTi) shape memory alloys (SMAs) undergo phase transformation between austenitic and martensitic phases in response to applied thermal or mechanical stress, resulting in unique properties and applications. However, machinability often becomes challenging due to property and temperature sensitivity attributes. The use of chilled air to influence machinability in macro-milling was investigated in this study. Other than that, differential scanning calorimetry (DSC) was used to determine the temperature of phase transformation. The results showed that milling with chilled air and minimal lubrication significantly improved machining performance by reducing tool wear and burr formation. Moreover, surface quality has also improved significantly. A notable discovery is that the machining process can change the critical conditions for phase transition, enabling new performance capability of tuning material hysteresis.

Keywords

Chilled air; Milling; Minimum quantity lubrication; Shape memory alloys; Sustainable machining