

Editorial

# Microstructure Change and Mechanism during the Metal Machining Process, Modeling, and Applications

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It is critical to understand the fundamental mechanisms during the metal-machining process. Machining parameters and tool geometries have significant effects on residual stress and metal microstructure changes, which include recrystallization, grain growth, crystallization evolution, and phase transformation. It is necessary to understand this mechanism to better predict the machining process.

Residual stress induced in metal machining is closely related to the performance and fatigue life of parts [1]. Fully understanding the generation mechanism is necessary for the prediction and control of residual stress. Mechanical load, thermal gradient, and phase transformation are believed to be the main three influence factors for the generation mechanism of residual stress [2]. Other microstructure evolutions, such as recrystallization and texture evolution, are neglected in most studies [3]. The source for microstructure evolution is supplied by the stored energy from work done in deforming. In metal machining, the material microstructure affects the process behaviors. Additionally, the mechanical and thermal loadings combined may lead to the microstructure evolution. The interaction between the process behaviors and material microstructure evolution is dynamic and coupled by flow stress.

Machining-induced microstructure changes include solid-state phase transformation, which affects residual stress and surface integrity [4–7]. In the machining of maraging steel 3J33b, the phase transformation includes the transfer of martensite and ferrite phases to austenite during heating as well as austenite to martensite and ferrite during cooling. The different lattice structures of the phases lead to the stress- as well as transformation-induced plasticity. Machining is the typical finishing process for microscale components that determines surface integrity. In addition, the phase transformation was ignored in the modeling of residual stress due to the lack of the phase transformation model. Therefore, it is imperative to model and control the phase transformation in machining.

All reviews and articles are welcomed to the current Special Issue entitled “Microstructure Change and Mechanism during the Metal Machining Process, Modeling, and Applications” to analyze and develop solutions regarding modeling and applications of microstructure change and mechanisms during the metal-machining process.

**Conflicts of Interest:** The authors declare no conflict of interest.



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