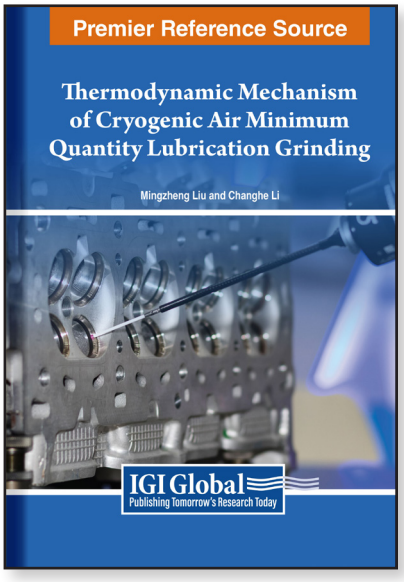
Thermodynamic Mechanism of Cryogenic Air Minimum Quantity Lubrication Grinding



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Description:

The achievement of high-efficiency and precise grinding of difficult-to-cut metals—like titanium alloys—is essential in the aerospace industry. However, the process often results in thermal damage to the workpiece surface, posing a significant technical challenge. While minimum quantity lubrication (MQL) has been used to aid titanium alloy grinding, its effectiveness is limited by insufficient heat dissipation and lubrication. As an alternative to normal temperature air for carrying micro-lubricants, Cryogenic air has shown promise in improving oil film heat transfer and lubrication performance in the grinding zone, thus reducing workpiece surface thermal damage. The experimental state of the technology demands more comprehensive studies on its effectiveness and on the underlying mechanisms.

Thermodynamic Mechanism of Cryogenic Air Minimum Quantity Lubrication Grinding addresses these challenges by providing a theoretical framework for understanding and optimizing cryogenic air minimum quantity lubrication in grinding processes, particularly for titanium alloys. It explores the physical characteristics of lubricants under cryogenic conditions, the influence of low temperatures on atomization effects, droplet formation dynamics, and heat transfer mechanisms within the grinding zone. By establishing quantitative relationships between cryogenic air parameters and lubricant properties, the book lays a foundation for enhancing the cooling lubrication mechanism of cryogenic air MQL in grinding processes. Researchers, scholars, and graduate students in universities and research institutes focusing on machining will find this book invaluable, as it goes beyond the theoretical insights into practical solutions to enhance grinding efficiency and reduce thermal damage.

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- Mechanical Lubrication
- Minimum Quantity Lubrication
- Thermodynamic Model
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