

## Single Point Turning Process Optimization of Fine Grain Processed 718

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### Abstract

The 718 family of nickel-base superalloys is used extensively in the design of critical aerospace components, namely in the hot section disks of gas turbine engines. The reliability of such components is often dependent upon, among other factors, their as-machined surface integrity. Surface integrity is often related to tool-surface interactions. The interactions may result in varying degrees of carbide cracking (possibly resulting in matrix cracking), carbide pull-outs, surface tearing, surface roughness, and grain distortion.

The very properties that make materials in the 718 family of nickel-base superalloys attractive for critical applications also make these materials difficult to machine. Among these properties are high temperature strength, poor thermal conductivity, and high work hardening rate. Conventional carbide tools tend to wear due to the increased temperature at the tool edge. This wear leads to an increasing required tool load, resulting in increased depth of grain distortion. Ceramic machining tools have shown promise for machining alloys in the 718 family, owing to their inherent high temperature strength and wear resistance. In addition to improved surface integrity, ceramics tools also offer significant improvement in machining throughput.

Through the design and analysis of factorial experiments, varied factors (feeds, speeds, depths of cut, tool types) are correlated with various response factors, including surface roughness, surface quality, depth of grain distortion, as well as microhardness and residual stress profiles.