Machining of Compacted Graphite Iron

Overview
Compacted graphite iron (CGI) is becoming more popular over gray iron in automotive and heavy equipment industries due to its higher strength leading to more effective and cost efficient engines. However, CGI lacks MnS2, which causes poor machinability and lower tool life. Quaker Chemical aims to provide its customers with a lubricant, which will be used in operations with CGI to compensate for the lack of MnS2.

Objectives
It is the goal of this study to determine which coolant will give the greatest extension in tool life, to draw conclusions regarding the effects of insert wear on machined surface hardness, and to analyze the microstructural features of the machined surface.

Approach
- Conduct a controlled high speed machining operation that simulated the boring of Grade 450 CGI on the SL-20 turning machine
- Determine the impact of three different metalworking fluids on the flank wear of the carbide inserts by analyzing the wear after each iteration of passes
- Perform tests at two different speeds to determine the n and C constants of the Taylor Tool Life Expectancy Equation for each fluid
- Perform a progression test using one of the coolants to measure hardness via Vicker’s Hardness test as a function of tool wear
- Conduct SEM analysis on prepared cross-sectional pieces to investigate microstructural features of the machined surface

Outcomes
- Quakercool 760 S provided the longest tool wear life among the three coolants at each speed
- All three coolants exhibited longer tool wear life at the slower speed
- Microstructural analysis displayed a surface layer, graphite microstructures, and pearlite microstructures
- The surface layer exhibited a lower hardness than unmachined CGI