FLUID PERFORMANCE IN THE MACHINING OF DUCTILE & COMPACTED GRAPHITE IRON

Overview
Quaker Chemical believes that the use of the proper cutting fluids may mitigate microstructure problems at or just below machined surfaces, as well as have a positive impact on tool wear rates. However Quaker Chemical currently lacks experimental data to show whether this is the case. Quaker Chemical is requesting experiments of relative machinability regarding two different machining fluids, Quakercool 7020 and Quakercool 3750, of CGI, gray, and ductile cast irons.

Objectives
1. Determine the Brinell Hardness of three types of cast iron samples supplied by Quaker Chemical: gray cast iron, ductile cast iron, and compacted graphite iron.
2. Analyze the microstructures of the three different types of cast iron samples by performing optical microscopy on the three sample materials at 500x and 1000x magnification.
3. Compare and analyze the impact of Quakercool 3750 and Quakercool 7020 on the tool wear resulting from the face milling of the three sample materials at two different sets of conditions.

Approach
- Cutting fluid was mixed to 8% concentration and titrated to confirm correct concentration
- HAAS VF-2 Machining Center was reserved and cleaned out to prevent fluid contamination
- Cast iron samples were machined to same initial geometry: 10in x 4.375 in x 1.907 in
- Brinell Hardness test was performed on each of the samples
- Machining studies were conducted at two sets of conditions using both coolants on all three metals using a CNC code prepared by FAME lab technician Dan Supko
- Used Nikon microscope with EclipseNet software at 3x to measure tool wear on the flank face of each insert
- Optical microscopy was performed at 500x and 1000x to observe the microstructure of the cast iron samples
- Data was compiled in Excel spreadsheet and average tool wear per pass was examined for each metal with regards to each coolant and machining conditions

Outcomes
- Quakercool 3750 significantly reduced tool wear rates when machining CGI at slower conditions
- Quakercool 7020 outperformed Quakercool 3750 for the machining of both gray and ductile cast irons
- No abnormalities were found in any of the iron samples with regard to microstructure
- Neither coolant can reduce the tool wear rate of CGI to compete with the machinability of gray and ductile cast irons