Lubrication and Tool Wear in the Turning of Powdered Metal M2 Steel Valve Seats Final Report

Overview
The Quaker Chemical Team 2 analyzed the effects of Quakercool 7102, Quakercool 7102-1731 (sulfur additive), Quakercool 7102-1683 (phosphorus additive), and Microcut 3680 lubricants with a polycrystalline diamond (PCD) cutting insert on M2 steel valve seats. Two parameters were collected in order to perform a statistical analysis to see how each lubricant compared to each other.

Objectives
The objective of this project was to analyze tool wear and the effect of select lubricants in the turning operation of powdered M2 metal valve seats. To establish a controlled environment a HAAS SL20 turning center was utilized and procedures were developed to assure each test was completed in the same manner. After each valve seat was cut, surface finish and tool wear was measured. Utilizing a One-Way ANOVA Test and Tukey’s Test, the collected data was statistically compared and conclusions about each lubricant’s resulting tool wear and surface finish were made.

Approach
- The scope of the project was defined during a meeting with our Quaker Chemical sponsor
- The team began to familiarize themselves with the necessary equipment in the FAME Lab that was to be used for this project and began planning an experimental approach.
- An experimental design was created so an analysis could be executed.
- The necessary parts and tools were ordered and received in order to start initial machining with the different lubricants and various setbacks were worked out.
- The lubricants were mixed and the different tests were run according to the given parameters provided by Quaker Chemical Corporation.
- The tool wear and surface finish data was collected for each test and recorded for further analysis.
- One-way ANOVA and Tukey’s Tests were performed on the data in order to determine which lubricant performed better than others

Outcomes
- In regards to the tool wear it was concluded, through statistical analysis done through Tukey’s Test and general observation, that Microcut 3680 performed the best out of the four lubricants.
- In regards to the surface finish it was concluded, through statistical analysis done through Tukey’s Test and general observation, that Microcut 3680 performed the best out of the four lubricants.
- It was also concluded that the phosphorus and sulfur additives in the Quakercool 7102 positively effected the tool wear and surface finish.