Overview
Quaker Chemical Corporation produces lubricants for machining cast iron. Our team had been asked design an experiment where we could quantify tool wear during machining of multiple grades of cast iron. We had also taken samples from each machined part to perform a microstructure analysis.

Objectives
- Simulate diesel engine cylinder boring through the use of a HAAS SL-30 Lathe, testing on three different grades of cast iron, to measure and analyze the microstructure of the surface layer that forms.
- Test the three cast iron samples using two cutting speeds to quantify the amount of tool wear.
- Perform a microstructural analysis on 500 Compacted Graphite Iron before and after machining.
- Form a regression model that predicts tool wear as a function of time and speed.
- Present results and conclusions on the insert wear rates and relative machinability differences of the three materials at the two cutting speeds.
- Determine if a surface layer forms on any of the cast iron samples.
- Investigate the formation and mechanical properties of the surface layer that forms on CGI samples and attempt to find a relationship with tool wear of the cutting tool.

Approach
- The team met with the sponsor to gather initial information about the scope of the project.
- The sponsor supplied the cast iron samples that they wanted machined.
- The project required time in the FAME Lab. Safety training had been completed to gain access to the use of the tools in this area.
- Training had also been completed to allow use of the ESEM.
- Design experiment parameters and measurement intervals.
- MINITab software was used to run a significance test on the variables in the experiment.
- Excell software was used to create regression models to predict tool wear.

Outcomes
- Useable tool life was determined for machining multiple grades of cast iron.
- Microstructure analysis completed on new cast iron alloys that have not been researched before.
- The grade of cast iron which has the highest machinability was determined.