Strain Transformations of Austempered Ductile Iron During Machining

Overview
Our team was tasked with the responsibility of performing a metallographic analysis on samples of austempered ductile iron that had recently been milled using differing parameters. The goal was to determine if a strain transformation due to the normal force of the tooling was taking place on the surface. If we observed the transformation taking place we were to take measurements of the layer and try to discern which of the 3 machining parameters had the largest effect on the layer formation.

Objectives
The objective we set for ourselves was to analyse 20 samples (2 from each of the ten sets given to us) to draw conclusions on which of the 3 machining parameters had the largest impact on the transformed layers.

Approach
- We received the 10 pre-milled coupons from a graduate student in the Industrial Engineering Department
- Each coupon had 2 samples cut out of it using the band saws at the Learning Factory
- All 20 of the samples were mounted, sanded, polished, and etched
- Each sample underwent a heat tinting treatment by being placed in an oven at 260 °C for 4 hours to bring out the microstructures (blue layer is the transformed layer)
- They were each analysed under an optical microscope to find a transformed layer at the surface. If a layer existed, it was measured using a measuring tool built into the microscopes software
- All the data was loaded into Minitab in order to find which machining parameter was the most influential in the formation of a layer

Outcomes
- This project was not about saving money or improving process times for the sponsor, it was about providing knowledge and research
- This was a research project for the sponsor on a topic of interest and debate in the cast iron field
- We determined that increasing the speed of the tooling leads to a deeper transformed layer on the surface
- The sponsor will use this information in further internal research