Fluid Performance in the Machining of Bi-Metal Components

Overview

In today’s automotive industry, the machining of engine components made of two different types of materials presents machinability problems due to the differing thermal properties, friction properties, and the nature of the chip formations.

Objectives

To focus on the study of bi-metal machining and the effectiveness of two metalworking fluids in regards to quality data such as cylindricity, surface finish, and reaming forces. A metallurgical analysis of the metals was also performed.

Approach

- Created bi-metal test pieces to mimic crank shaft line boring process
- Design and machine fixture to mount pieces during machining operations
- Perform pre-machining metallurgical analysis of the metals
- Determine which parameters to test for post-machining
- Machine test holes into test pieces to collect quality data
- Collected reaming force, cylindricity, and surface finish data on all test holes
- Performed post-machining metallurgical analysis
- Compared collected quality data across fluids using a paired t-test in Minitab
- Used t-test results to determine which fluid, if any, performed better

Outcomes

- Determined that there was no significant difference in the machinability of the bi-metal pieces from one fluid to another
- Gathered valuable data for the sponsor to better understand the problem and aid in the improvement of their cutting fluids.
- Provided important information on the metallurgical aspects of each of the materials such as density and porosity