



CGI: Properties, Uses, and Challenges Faced in Metal Removal Operations

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Abstract

The goal to design and produce more fuel efficient engine systems has forced manufacturers to design engines with higher power to weight ratios. This trend has led to the increasing use compacted graphite iron (CGI) as a replacement to gray iron. With a tensile strength, modulus of elasticity, and fatigue strength 75%, 40%, and 100% higher than that of gray iron, respectively, stronger and lighter engine components can be cast with CGI. Unfortunately, the properties that make CGI such an advantageous alloy to use also contribute to its poor machinability. The tool life in machining CGI can be 10 to 20 times less than that of gray iron. The absence of manganese sulfide inclusions in CGI, which form a wear reducing protective inorganic film on tools used in gray iron machining, is a significant contributor to the difference in tool life between the two alloys. Our approach in designing a metalworking fluid for CGI machining, aims to mimic the effect of the MnS inclusions. Our goal is to design a metalworking fluid with tribochemically active additives that will deposit a protective coating on the cutting edge of the tool, decreasing the rate of tool wear in CGI machining. Some approaches investigated thus far are the use of sulfur based additives, passive EP additives, and phosphorodithioates. In this presentation, the metallurgy of CGI, the reasons for its increasing use, the results of the investigated approaches, and the future directions of this ongoing project will be discussed.