Increasing the lifespan of high pressure die cast molds subjected to severe wear

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Abstract

Despite the increasingly incorporation of composite materials on vehicle components, high pressure die casting still remains one of the most useful manufacturing techniques to obtain automotive parts with complex shape in a cost effective way. It is well known that automotive industry requires high production cadency as well as high products quality. Thus, systematic approaches are permanently being done leading to optimize all the production and management aspects.

The aluminum alloys commonly used in automotive parts such as fuel pumps bodies, throttle bodies, EGR valves, support brackets and so on usually contain Silicon which presents high abrasively. The aluminum flow at high temperature and high speed into the mold induces severe wear, sometimes due to a combination of abrasion and erosion effects.

In this study, two molds with typical severe wear problems were selected and the wear mechanisms involved were deeply studied. After that, a careful selection of the best coating for this purpose was done and some of the most critical parts of the mold were coated in order to test possible effective advantages of the coating application, analyzing the wear resistance behavior and wear mechanisms involved. In parallel, tribological tests were also carried out in order to study if a correlation between laboratorial and industrial tests can be drawn. Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy were intensively used to characterize the coatings and the wear mechanisms observed. Laboratorial tribological tests have involved ball scattering and block-on-ring tests, trying to impose low and medium loads on the contact, respectively. Promising results were obtained allowing to conclude that certain coatings present a better behavior than other ones in this field of application.

Keywords: Wear, Abrasion, Erosion, High-pressure die casting, Mold wear, Wear mechanisms, Mold lifespan

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