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Current Issues and Future Prospects for the Application of Light-Weight Alloys and MMCs for Friction- and Wear-Critical Components in Cars and Trucks

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Abstract

The desire for improved energy-efficiency of ground vehicles has lead to a number of programs designed to substitute light-weight materials for steel and cast iron in engines and chassis components. Some automotive and truck components have additional requirements for wear resistance and/or low-friction. Examples include fluid pump gears, pistons, and brake discs. Some of the light-weight materials of current interest, like alloys and composites of aluminum and magnesium, are not historically viewed as effective bearing materials. Their relatively high ductility, low hardness, tendency to transfer to the rubbing counterface, corrosion susceptibility, and sensitivity to abrasion by harder particles can lead to undesirably high wear rates. In addition, current lubricant technology has emphasized the tribochemistry of ferrous surfaces, and has not devoted nearly as much effort into lubricant formulation for light-weight bearing materials. Metal matrix composites (MMCs), while offering improved strength and toughness over light alloys, can nevertheless suffer from problems associated with the action of freed hard particles in the wear debris. This paper will discuss some of the metallurgical issues associated with the use of light-weight materials for friction- and wear-critical components, including the selection of coatings and surface treatments to overcome their shortcomings.

Key words: aluminum alloys, magnesium alloys, metal matrix composites, friction, wear, coatings

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