

A Comparative Life Cycle Assessment of Magnesium Front End Autoparts

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Abstract

The Magnesium Front End Research and Development (MFERD) project under the sponsorship of Canada, China, and USA aims to develop key technologies and a knowledge base for increased use of magnesium in automobiles. The goal of this life cycle assessment (LCA) study is to compare the energy and potential environmental impacts of advanced magnesium based front end parts of a North American-built 2007 GM-Cadillac CTS with the standard carbon steel based design. This LCA uses the “cradle-to-grave” approach by including primary material production, semi-fabrication production, autoparts manufacturing and assembly, transportation, use phase and end-of-life processing of autoparts. This LCA study was done in compliance with international standards ISO 14040:2006 [1] and ISO 14044:2006 [2]. Furthermore, the LCA results for aluminum based front end autoparts are presented. While weight savings result in reductions in energy use and carbon dioxide emissions during the use of the car, the impacts of fabrication and recycling of lightweight materials are substantial in regard to steel. Pathways for improving sustainability of magnesium use in automobiles through material management and technology improvements including recycling are also discussed. Overall large magnesium structural parts can provide environmental benefits in terms of energy use and GHG emissions vis-à-vis steel within the expected life of the car. But overall, the aluminum design is still better at achieving the breakeven distance from energy use and GHG emissions perspectives within the vehicle life.

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References

1. International Standard, “Environmental Management - Life Cycle Assessment - Principles and Framework,” ISO 14040:2006, 2006.
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