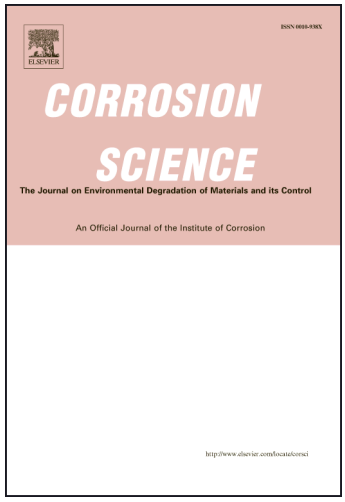

Controlling the ignition and flammability of magnesium for aerospace applications

Frank Czerwinski

PII: S0010-938X(14)00218-2
DOI: http://dx.doi.org/10.1016/j.corsci.2014.04.047
Reference: CS 5841

To appear in: *Corrosion Science*

Received Date: 31 December 2013
Accepted Date: 28 April 2014

Please cite this article as: F. Czerwinski, Controlling the ignition and flammability of magnesium for aerospace applications, *Corrosion Science* (2014), doi: http://dx.doi.org/10.1016/j.corsci.2014.04.047

CONTROLLING THE IGNITION AND FLAMMABILITY OF MAGNESIUM FOR AEROSPACE APPLICATIONS

Frank Czerwinski

CanmetMATERIALS, Natural Resources Canada, 183 Longwood Road South, Hamilton, Ontario, L8P 0A5, Canada

Tel: +1 905 645 0887; fax +1 905 645 0763; email: Frank.Czerwinski@nrcan.gc.ca (Frank Czerwinski)

Abstract

The perceived easy ignition and flammability of magnesium alloys create a detrimental safety feature that overshadows their high strength-to-weight ratio and hinders the aerospace application opportunities. To overcome the existing barriers a progress in understanding and controlling the reactivity of magnesium at high temperatures is required. This report describes fundamentals of magnesium ignition and flammability along with laboratory testing procedures and correlations with full scale fire scenarios, related in particular to the aircraft cabin. The influence of alloying elements on high temperature reactivity of magnesium and global efforts to develop ignition resistant and non-flammable magnesium alloys are reviewed. Although ignition and flammability represent quite different quantities, both are controlled by an oxidation resistance of the alloy and its capability to form a dense and protective surface oxide after exposures to an open flame or other heat source. Since surface oxide, composed of pure MgO, does not offer a sufficient protection, the research strategy is focused on modification of its chemistry and microstructure by micro-alloying the substrate with rare earths and other elements having high affinity to oxygen.

Key words: *magnesium alloys, ignition, flammability, high-temperature oxidation, rare earths*