

An Indian-Australian research partnership

Localized corrosion and stress corrosion cracking of magnesium alloys

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The problem

The high strength-to-weight ratio and low density of magnesium alloys promise their great potential as light construction materials for automotive/aerospace applications. The major stumbling block restricting commercial application of magnesium alloys is their poor corrosion resistance.

Corrosion studies of magnesium alloys have some exciting industrial and novel significance. In this respect, the research topics of particular interest are:

1. Australian Defence Science and Technology Organisation (DSTO) require to address the problem of extensive localized corrosion in the gear-box, which is constructed out of a Mg-Zn-Rare-earth-alloy, ZE 41, i.e., the material of construction for gear box of a family of Royal Australian Navy (RAN) helicopters (the gear box undergo extensive localized corrosion). The problem occurs exclusively at the interface where the gear-box sits over a platform made out of other alloy. It will be necessary to investigate the surface modification/engineering, for an effective and durable corrosion mitigation.
2. Innovative use of magnesium alloys as biodegradable orthopaedic implants. Accomplishment of this work may provide an extremely advantageous path to avoid the need for second surgical operation that are commonly required for removal of certain implants of currently used materials. The novel idea of orthopaedic application of magnesium alloys hinges primarily on: (a) the extraordinarily high corrosion rates of magnesium and its alloys, (b) corrosion products of magnesium being non-toxic and easily excretable from human body, and, (c) the possibility of suitable tailoring the surface of magnesium alloys for achieving different rates of surface dissolution, in order to suit different situations of orthopaedic applications. The major tasks and challenges include: (a) identification of a suitable surface modification technique, in order to achieve surface with suitable corrosion/dissolution rate in simulated human body fluid in different orthopaedic applications, and (b) characterization of stress corrosion cracking in simulated human body fluid of the alloy with the identified surface modification.