Cladding of Mg alloy with Zr based BMG Alloy

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Abstract. In the present work, an attempt has been made to clad AZ31 magnesium alloy with Zr-based bulk metallic glassy alloy (Vit-1), by casting method. The interface studies conducted using SEM-EDS line scan indicate that a good bond is formed at the clad interface of Zr and Mg. And the mechanism involved is discussed herein.

1. Introduction

Magnesium alloy sheet applications have been growing in transportation systems in recent years. Recent development of twin-roll casting technology has shown that it can efficiently produce low cost, high performance wrought Mg alloy sheet products having equivalent mechanical properties to conventional ingot cast Mg alloys. On the other hand, unfortunately, Mg alloys exhibit poor resistance to corrosion which is a serious problem which limits their applications in wider domains. Several research attempts had been done till now in protecting Mg from corrosion. Most of them were through alloying additions and coatings. As a part of these efforts, present authors have recently developed a new technology of cladding Al on the surface of the Mg alloy strips through twin-roll casting process [1-2]. Another such cladding was done on Mg alloys using a bulk-metallic glassy Zr alloy, in the present work using injection casting in inert atmosphere. It is known that cladding of Zr on Mg alloys improves the corrosion resistance of the later [3]. On the other hand, bulk metallic glasses also have superior corrosion resistance. Most of the research work done till date deals with laser-cladding process [3-5], which has its economic limitations for large scale set-up. However, the present work deals with a casting process which can result in a Zr alloy clad Mg alloy. The detailed experimental work and the results obtained are discussed in the following sections.

2. Experimental Details

A well-known bulk metallic glass, the Vit-1 alloy (in ribbon form ~50μm thick) has been chosen for cladding Mg alloy (AZ31) in the present investigation. As mentioned above the clad specimens were obtained by injection casting of molten magnesium alloy in to a water-cooled copper mould cavity containing Zr alloy ribbons. In fig.1 (a-c) below, a detailed procedure of cladding is explained. Fig.1 (a) shows a schematic diagram of the copper mould with BMG ribbon affixed to its mould walls using a double-sided copper adhesive tape. In the next stage, molten magnesium alloy at 700°C is injected into the mould cavity shown in fig. 1(b) under inert atmosphere and allowed it to cool to room temperature. Once the casting is done, the mould was opened and the Mg alloy casting obtained was