Magnesium (Mg) is a light-weight metal that has extraordinary physical and chemical properties for many potential applications in automobile, military, and electronics. Aluminum alloys, because of its light-weight, high strength and corrosion resistance have a wide range of commercial applications. Given these two, sometime competing, alloy systems, there are now many applications where the metallurgical compatibility of Mg- and Al-alloys are required for engineering applications. One such case is the development of diffusion barrier for U-Mo metallic fuel in Al-alloy cladding, where Mg, with its complete immiscibility with U and Mo is being considered as the diffusion barrier. While negligible diffusional interaction between Mg and U-Mo alloys have been reported, diffusional interaction between the Mg and Al-alloy cladding has not been investigated.

In this study, solid-to-solid diffusion couples were assembled using discs of pure Mg (99.999 %) and AA6061 Al-alloy. After preparation, Mg was diffusion bonded to AA6061 in sealed quartz capsule at 300°C, 350°C, and 400°C for 720, 360, and 240 hours, respectively. Scanning electron microscopy was used to inspect the interdiffusion zone, while phase identification was performed using X-ray energy dispersive spectroscopy. One specific phase that exist in the binary Mg-Al system, labelled ε was observed and characterized by transmission electron microscopy. From the preceding data, the growth rates as well as interdiffusion coefficients of the intermetallic phases were extracted and compared to previous investigations using pure Mg and Al.