Magnesium (Mg) Metal matrix composites (MMCs) reinforced by ceramic reinforcements are being developed for a variety of applications in automotive and aerospace because of their strength-to-weight ratio. Reinforcement being considered includes SiC, Al2O3, Carbon fiber and B4C in order to improve the mechanical properties of MMCs. Microstructural and interfacial characteristics of MMCs can play a critical role in controlling the MMCs' mechanical properties.

This study was carried out to understand the microstructural and interfacial development between Mg-9wt.Al-1wt.Zn (AZ91) alloy matrix and several reinforcements including SiC, Al2O3, Carbon fibers and B4C. X-ray diffraction, scanning electron microscopy and transmission electron microscopy was employed to investigate the microstructure and interfaces. Al increase in hardness due to the presence of reinforcements was also documented via Vicker's hardness measurements.

Thermodynamic consideration based on Gibbs free energy was employed along with experimental results to describe the interfacial characteristics of MMCs. Reaction products from AZ91-SiC and AZ91-Al2O3 interfaces were identified as MgO, since the surface of SiC particles is typically covered with SiO2 and the MgO is the most thermodynamically stable phase in these systems. The AZ91-Carbon fiber interface consist of Al4C3 and this carbide phase is considered detrimental to the mechanical toughness of MMCs. The AZ91-B4C interface was observed to contain MgB2 and MgB2C2. In general, Vicker's hardness increased by 3X due to the presence of these reinforcements.

Approved for distribution by Dr. Yongho Sohn, Committee Chair, on June 5, 2012.

The public is welcome to attend.