The aim of the present doctoral thesis was to reveal the active deformation mechanisms in novel high strength magnesium (Mg) alloys using advanced *in-situ* techniques with high time and space resolutions. The deformation behavior of two extruded Mg-LPSO alloys with a different volume fraction of the long-period stacking ordered (LPSO) phase was investigated in tension and compression at room temperature and in compression at 200 °C, 300 °C, and 350 °C. In order to support the results obtained by *in-situ* acoustic emission and synchrotron diffraction methods, detailed microstructure investigation was provided by transmission and scanning electron microscopy, particularly the backscattered electron imaging and electron backscatter diffraction technique were used.

The results indicate that both temperature and the LPSO phase content significantly influence the plasticity of the magnesium matrix, particularly they affect the activation of extension twins and non-basal slip. Moreover, both parameters have a high impact on the formation of the deformation kinks in the LPSO phase.

Keywords:

Mg-LPSO alloys, deformation mechanisms, acoustic emission, synchrotron diffraction, *in-situ* methods.