Mg$_2$Si is one of promising materials for thermoelectric devices consisting of nontoxic and abundant elements. In recent study by Nakamura et al. [1], high-performance Mg$_2$Si thermoelectric devices were successfully obtained by spark plasma sintering (SPS) of pre-synthesized, all-molten Mg$_2$Si powder sandwiched between Ni powders on both sides. They investigated the interface between Ni electrodes and Mg$_2$Si sintered bodies of their devices and observed boundary layer at the interface by SEM and EDX.

In this work, we further carried out cross-sectional transmission electron microscope observation of the boundary layer to characterize and identify their nature. The device was fabricated by simultaneous SPS of Al-doped Mg$_2$Si powder and Ni powders, which is described in detail in Ref. [1]. The TEM sample was picked up at the interface by FIB and was observed by JEOL JEM-4010 high resolution TEM.

Figure 1 shows cross-sectional TEM image at the interface of the sample. The image indicates that the boundary layer was divided into more than 4 regions with different grain sizes and different atomic compositions of Mg, Si, and Ni. The detailed results will be presented in the meeting.