SPS 法で作製した Ni-Mg₂Si 界面の断面 TEM 観察 (2)

Cross-sectional TEM observation of Ni-Mg₂Si interface prepared by SPS method (2)

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Mg₂Si is one of promising materials for thermoelectric devices consisting of nontoxic and abundant elements. In recent study by Nakamura *et al.* [1], high-performance Mg₂Si thermoelectric devices were successfully obtained by spark plasma sintering (SPS) of pre-synthesized, all-molten Al-doped Mg₂Si powders sandwiched between Ni powders on both sides. In the last work [2], we presented a cross-sectional image of a boundary layer between Ni electrode and Mg₂Si body of the device taken by JEOL JEM-4010 high resolution TEM. In this work, we describe crystalline phases of the boundary layer.

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. From electron diffraction analysis we identified the region I nearest to the Mg₂Si body as " ω -phase" (hP55) {suggested atomic composition Mg₃₃Si₃₇Ni₃₀}, and the regions II, III, and IV as " η -phase" (cF116) {Mg₂₀Si₂₄Ni₅₆}; both of the intermetallic phases are designated in Ni-Mg-Si ternary phase diagram [3]. The region near the Ni electrodes consisted of Ni-phase and MgNi₂ phase.

References: [1] S. Nakamura, Y. Mori, & K. Takarabe, J. Elec. Materi. 43 (2014), 217. [2] H. Sugawara,
Y. Yamazaki, S. Nakamura, S. Nakamura, Y. Mori & K. Takarabe, 75th JSAP Autumn Meeting, 20a-A27-5 (2014). [3] Y.K. Song and R.A. Varin, Metallur. & Mater. Trans. A32 (2001) 5.



Fig.1 Cross-sectional TEM image at the interface of Ni electrode (left) and Mg₂Si sintered body (right). Intermetallic phases identified by electron diffraction analysis are also indicated in the figure.