# Developing Powder for Functional/Structural Materials and Microstructural Observation

**Mitsuhiro TAKEDA**

**Associate Professor** m-takeda@sendai-nct.ac.jp

**Affiliated Societies**
The Japan Institute of Metals and Materials
The Japan Society of Powder and Powder Metallurgy
The Fullerenes, Nanotubes and Graphene Research Society

**Keywords** Structural materials and functional materials-related (26040)

## Research Topics

- Synthesizing metal-based composites by mechanical alloying
- Structural analysis and microstructural observation using electron microscopy

## Research Seeds

1. Synthesis of metal-based composites by mechanical alloying

Figure 1 shows a cross-sectional TEM image of spherical fine β-$FeSi_2$ by a converge mill (CM). The selected area diffraction pattern in Figure 1 revealed that the powder consists of non-equilibrium phase involving nanocrystallite β-$FeSi_2$ [1]. Such direct synthesis of the spherical fine powder is difficult using other ball milling machines. The CM is a powerful, quick, and low-contamination process that can be applied to development of new functional materials and fine powder materials. Furthermore, we are studying mechanical properties of green compact.

2. Structural analysis and microstructural observation by electron microscope

The long-period stacking (LPS) type Mg alloy is attracting attention as a next-generation lightweight structural material. A new phase with a 10H-type LPS structure was found in an $Mg_{75}Al_{10}Y_{15}$ alloy annealed at 823 K [2]. Figure 2 shows a Cs-corrected STEM image and structural model of $Mg_{75}Al_{10}Y_{15}$ alloy. The bright dots in Figure 2 (d) correspond to Y atom. We clarified that an $Mg_{75}Al_{10}Y_{15}$ alloy has a highly ordered arrangement of $L1_2$ structural block consisting of Y and Al atom.

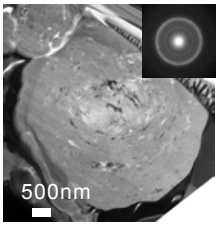


Figure 1

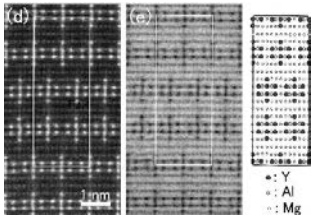


Figure 2

[1] M. Takeda et al., 16th International Microscopy Congress, Sapporo 1629 (2006)
[2] M. Takeda et al., Philosophical Magazine, vol.98 (2018) 2247-2256

## Related Technology

- Synthesis of metal-based fine composite powders
- Structural analysis of materials using electron microscopy