Tohoku Univ. Technology

Rare-earth free ferromagnetic particle powder showing BH_{max} above 6 MGOe

Realization of α"-$Fe_{16}N_2$ particle powder with giant saturation magnetization

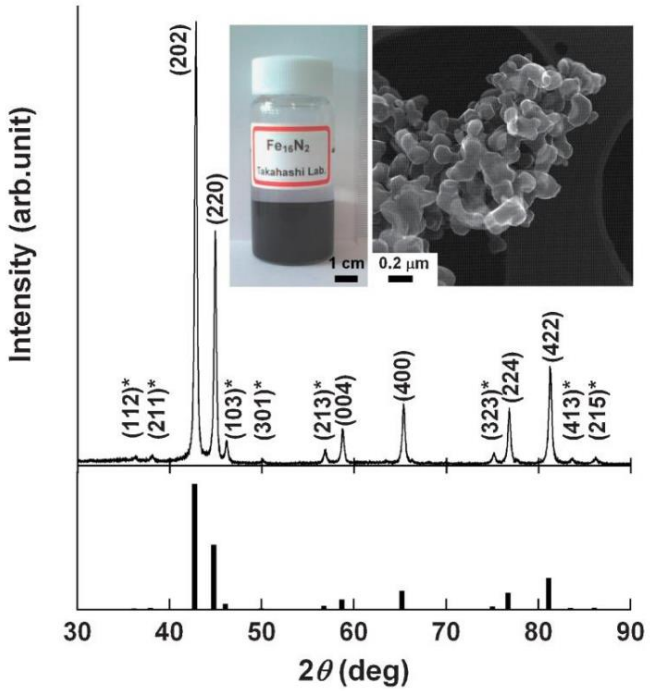
Overview

The international market price of neodymium has increased significantly in recent years. The reason seems to be the increasing demand for wind-power generation and electric vehicle motor in China where the country is promoting decarbonization as a national policy. In addition, the perspective of economic security is discussed in Japan and there is a strong demand for magnetic material which does not contain rare earth. Low cost Fe-N magnetic material consisting only of iron and nitrogen has especially high expectation. In particular, α"-$Fe_{16}N_2$ which has BCT structure and predicted to have high magnetic saturation, has attracted much attention.

However, α"-$Fe_{16}N_2$ is a metastable compound that crystallizes when Fe-N compound is annealed, and there is almost no report of its isolation as a bulk material. The only few reported cases mention about eutectic crystal of α"-$Fe_{16}N_2$ and stable phase, or the existence for only 10 days at 100° C, so there is no example of α"-$Fe_{16}N_2$ single phase stable isolation as a bulk.

This invention is about the α"-$Fe_{16}N_2$ stable isolated powder. This magnetic powder shows a BH_{max} of more than 6 MGOe (48 kJ/m^3), which is higher than ferrite and alnico. It also shows the saturation magnetization of 221 emu/g which exceeds metallic Fe, and the coercivity of more than 2 kOe (160 kA/m) which is higher than alnico and comparable to ferrite. Since this magnetic powder can produce magnet that outperforms ferrite and alnico without using rare earth, it is expected to be used in motor, etc. as an alternative to neodymium magnet which continues to rise in price.

Succeeded to isolate stably α“-$Fe_{16}N_2$



Product Application

- ☐ Anisotropic magnet
- ☐ Compacted magnet
- ☐ Bonded magnet
- ☐ Other applications such as substitute magnets for neodymium magnet in motor, etc.

Related Works

[1]*Appl. Phys. Exp.* 2013, **6**, 073007. [2]*Chem. Commun.* 2013, **49**, 7708. [3]*Chem. Commun.* 2014, **50**, 7040. [4]*J. Appl. Phys.* 2014, **115**, 103905. [5]*Phys. Rev. B* 2014, **90**, 134427. [6]*J. Magn. Soc. Jpn.* 2017, **41**, 58.

IP Data

IP No. : JP5769223, JP5822188, JP5831866 (And corresponding overseas rights)
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