

Size control of coordination nanosheet by alkyl termination

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Coordination nanosheets (CONASHs) are two-dimensional materials composed of planar ligands and metal ions.¹ Their physical and chemical properties can be controlled by the ligand and the metal, which leads to a wide variety. NiBHT, which is synthesized from nickel ions and benzenehexathiol (BHT), is an example of CONASHs and known for its high electrical conductivity.² CONASHs investigated so far have a small thickness of a few to hundreds of nanometers and a large area of several micrometers or more. It has not yet investigated what happens when the size of a CONASH is confined to nanometer scale. The electrons confined in a nanoparticle exhibit a new property different from that in a bulk material. Therefore, a nanoparticle, or a nanoflake of CONASH is expected to show a different physical and chemical properties but has not yet reported.

In this study, we report the synthesis of alkyl-terminated NiBHT nanoflakes, which can stably disperse in organic solvent. A MeOH solution of nickel acetate was added to a THF solution of BHT as the bridging ligand and 4,5-dihexylbenzene-1,2-dithiol as the capping ligand (Fig. 1a). Dark green dispersion was obtained without precipitation. The particle size was measured with dynamic light scattering (DLS) as 30 nm (Fig. 1b). Its IR spectrum shows that it is alkyl-terminated NiBHT. Without the capping ligand, a large amount of precipitation of NiBHT was produced as a black solid. The supernatant was measured with DLS to reveal that the particle size was larger than alkyl-terminated NiBHT. These results indicate that the capping ligand controls the size of NiBHT nanoparticle by stopping its growth.

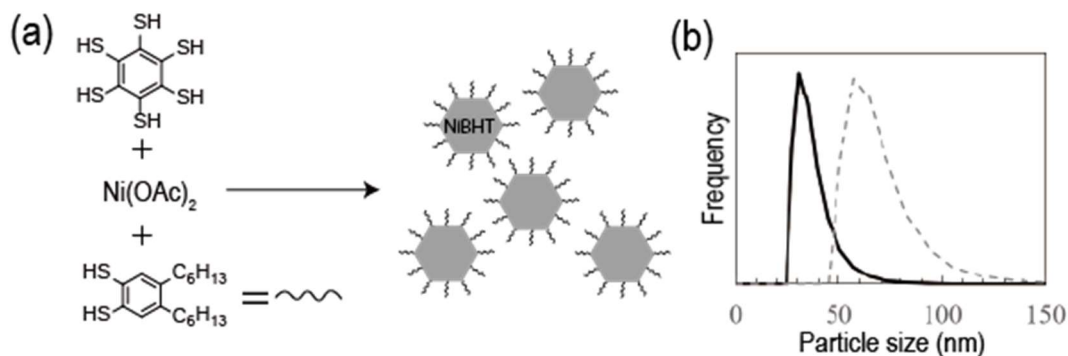


Figure 1. (a) The scheme of the synthesis of alkyl-terminated NiBHT. (b) The DLS histogram of alkyl-free NiBHT (dashed line) and alkyl-terminated NiBHT (solid line).

1) H. Maeda *et al.*, *Coord. Chem. Rev.*, **2022**, 470, 214693. 2) a) T. Kambe *et al.*, *J. Am. Chem. Soc.* **2013**, 135, 2462-2465. b) T. Kambe *et al.*, *J. Am. Chem. Soc.* **2014**, 136, 14357-14360.