The Formation and Controlled Size of Ceramic Nanoparticles Using the Thermal Oxidation in Mesoporous Silica Templates
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Abstract
This work demonstrated the formation of ceramic nanoparticles within the mesoporous silica templates. The mesoporous silica materials were obtained by some modification of conventional sol-gel methods of SBA-15, and the ceramic nanoparticles were obtained by the thermal growing in air after aqueous cation binding in mesoporosity. The characterization was done with XRD, BET, TEM, and SEM as a function of calcination temperature. Moreover, the metals were changed to transition metal such as Co, Ni, Fe, Cu, Zn from alkaline earth metals such as Mg, Ca, Sr, Ba. The mesoporous silicas including an alkaline metal such as Na, K, Cs showed the nanocluster morphology and well ordered nanoporosity. The transition metals showed the thermal growing pattern within the mesoporous silica. The surface areas and BJH pore size contributions were demonstrated by BET. After the formation of metal nanoparticles by thermal oxidations, the silica was removed and then formed metal oxide nanoparticles were collected separately to confirm the characteristics. These results could be applied to the bio-catalytic fields such as antibiotics or anti-bacterial.

The Pyrophosphoric Acid Coating for Enhancement of Anti-oxidation on Graphites Surfaces
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Abstract
This work reported a pyrophosphoric acid coating for enhancement of anti-oxidation on graphite surface coating. We demonstrated some material for effective anti-oxidation coating such as phosphoric acid, polycarbosilane, pyrophosphoric acid, and changed their combinatorial composition ratio, number of coating times, thermal drying. Among these materials, the pyrophosphoric acid showed only an enhancement of anti-oxidation on graphite surface. Most results were obtained by thermal gravimetric analysis (TGA), scanning electron micrographs (SEM), and FT-IR spectroscopy. Supplementary analysis were adapted on BET (surface areas and pore-size distribution), and optical micrographs. The anti-oxidation property showed the order of graphite < phosphoric acid << pyrophosphoric acid. Moreover, the higher number of coating times at the same materials gave the large anti-oxidation property. The reason why pyrophosphoric acid gave the large anti-oxidation property rather than phosphoric acid is attributed that two phosphate(PO42-) groups of pyrophosphoric acid was strongly and bounded on the graphite surfaces rather than phosphoric acid. Consequently the pyrophosphoric acid coating provided the more compact interaction between the surface and phosphate anions.