A novel preparation method for synthesis nanoparticles Ce-Mg-O powder

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Abstract: A new nanoparticles material of Ce-Mg-O mixed oxide powder is synthesized by a new preparation method of modification of macromolecule surfactant. The key factor is to using polyethylene glycol-20000 and 1-butanol azeotropic distillation process to control the particle size growth of the powder even after the high temperature treatment. It is a novel preparation method to produce a new nanoparticles material with the advantage properties of nanoparticles, high surface area, agglomeration-free in 1000℃ high temperature.
Keywords: Nanoparticles powder, Ce-Mg-O, preparation method.

Now, nanoparticles material has attracted many interests and has many promising application. There are many attention have been paid to the formation of agglomeration-free nanoparticles of metal oxide. Some methods for preparation nanoparticles have been reported, such as, sol-gel method, electrochemical method, liquid phase deposition method. But the common problem is difficult to control the particle size of nanoparticles material growth over 1000℃ high temperature treatment. However, so far no reports were found to synthesis the nanoparticles material Ce-Mg-O powder. In this paper, a new preparation method is reported to control the nanoparticles growth with the high temperature treatment. This new preparation method has the advantages of inexpensive; keep the powder from sintering and agglomeration, nanosized particle and high surface area.

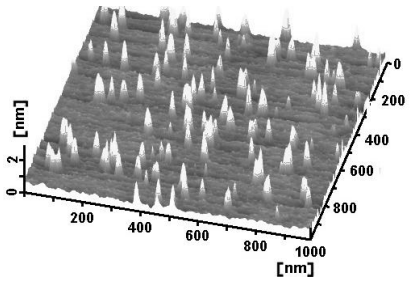

Figure 1. AFM diagram of Ce-Mg-O powder.

The average value of the crystallite size of the synthesized Ce-Mg-O powder is within 20 nm (shown in Figure 1). The BET surface area data listed in Table 1 indicates that the high surface area is great linked with the preparation conditions and adding of Mg. All the Ce-Mg-O samples have lager surface area compared with CeO_2. Among them, $Ce_{0.1}Mg_{0.9}O_{1.1}$ is nearly three times larger than pure CeO_2. The key factor is due to the treatment by modification of macromolecule surfactant and dry water by azeotropy distills with organic substance. The excellent process can effectively prevent the agglomerates between powder molecules, even at 1000℃ high temperature.

Table 1. Surface areas of Ce-Mg-O mixed oxide powder at different calcinations temperature

Sample	BET surface area (m^2/g)		
	600℃ calcination	800℃ calcination	1000℃ calcination
CeO_2	26.6	10.3	6.8
$Ce_{0.1}Mg_{0.9}O_{1.1}$	68.6	28.8	19.6
$Ce_{0.5}Mg_{0.5}O_{1..5}$	66.8	20.4	18.9
$Ce_{0.9}Mg_{0.1}O_{1.8}$	50.1	18.8	15.4