

湿化学法制备 Y_2O_3 纳米粉及透明陶瓷

闻雷^{1,2}, 孙旭东², 其鲁¹, 徐国祥¹

1. 北京大学化学与分子工程学院应用化学系新能源材料与技术实验室, 北京 100871;

2. 东北大学材料与冶金学院, 沈阳 110004

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摘要

以 $Y(NO_3)_3$ 溶液和 $NH_3 \cdot H_2O$ 为原料, 制备了 Y_2O_3 纳米粉体. 先驱沉淀物的化学组成为 $Y_2(OH)5NO_3 \cdot H_2O$. 研究了 pH 值及滴加过程对先驱沉淀物形貌及 Y_2O_3 产物烧结性的影响. 正向滴定, pH 值较低时 (pH=7.9), 先驱沉淀物为片状结构; pH 值较高时 (pH=10.0), 先驱沉淀物片层状结构特性减轻, 并且颗粒变的细小. 反向滴加时, 片层状结构特征消失, 主要为块状晶粒. 先驱沉淀物为片状结构时, 得到的粉体活性较高. 添加适量的 $(NH_4)_2SO_4$ 能够减轻 Y_2O_3 粉体的团聚, 沉淀的同时控制 pH 值在 9 以下, 所得到的粉体具有更好的烧结性能. 采用得到的 Y_2O_3 纳米粉, 不加入任何烧结助剂, 经 $1700^\circ C$ 真空烧结 4h 得到了透明 Y_2O_3 陶瓷.

关键词 [Y2O3](#) [透明陶瓷](#) [光学性能](#) [纳米粉](#)

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Solution-based Processing of Y_2O_3 Nanopowders Yielding Transparent Ceramics

WEN Lei^{1,2}, SUN Xu-Dong², QI Lu¹, XU Guo-Xiang¹

1. New Energy Materials and Technology Laboratory, Department of Applied Chemistry, Peking University, Beijing 100871, China;

2. School of Materials and Metallurgy, Northeastern University, Shenyang 110004, China

Abstract Nanocrystalline yttria powders were synthesized from $Y(NO_3)_3$ solution and ammonia water by a precipitation method. The chemical composition of the hydroxide precursor was $Y_2(OH)5NO_3 \cdot H_2O$. The effects of pH values and striking process on the properties of hydroxide precursor and resultant yttria powders were studied. At low pH conditions (pH=7.9) of the normal striking method, the precipitation precursor has a layered structure. If the final pH value is comparatively high (pH=10.0), the layered nature of the precipitation precursor decreases, and the crystallites are more fine. By using reverse-strike technique, the layered nature of the flocs disappears, and it is mainly composed of more equiaxed crystallites. More sinterable yttria powders can be synthesized by calcining the hydroxide precursor with platelet-shaped structure. A small amount of ammonium sulfate doping can reduce the agglomeration of the resultant yttria powders. Resultant Y_2O_3 powders synthesized at a low pH (below 9) show much better sinterability than those from higher pH value derived precursor. By using the nanocrystalline yttria powder, transparent yttria ceramics were produced by vacuum sintering at $1700^\circ C$ for 4h without any additives.

Key words [Y2O3](#) [transparent ceramics](#) [optical properties](#) [nanopowders](#)

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通讯作者 闻雷 wenleicn1974@163.com

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