高等学校化学学报 2010, 31(3) 447-451 DOI: ISSN: 0251-0790 CN: 22-1131/O6



论文

# $Fe_3O_4$和$Zn^{2+}$掺杂型$Zn_{1-x}Fe_{2+x}O_4$纳米晶的溶剂热合成和电磁性能

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摘要:

利用溶剂热法, 在醋酸钠静电保护剂的辅助下, 成功制备出$Fe_3O_4$和$Zn^{2+}$掺杂型$Zn_{0.07}Fe_{2.93}O_4$纳米晶. 利用X射线衍射仪和扫描电子显微镜等对样品的晶体结构、粒径、形貌和化学组成进行了分析. 结果表明, 所得纳米晶的粒径均匀, 形貌为球形, 分散度好; $Zn_{0.07}Fe_{2.93}O_4$纳米晶的平均粒径(70 nm)明显小于$Fe_3O_4$(170 nm). 磁性能测量结果表明, 室温下$Zn_{0.07}Fe_{2.93}O_4$的饱和磁化强度(54.2 $A·m^2·kg^{-1}$)小于$Fe_3O_4$ (81.6 $A·m^2·kg^{-1}$). 利用矢量网络分析仪对样品的电磁性能和吸波性能进行了研究. 结果表明, $Zn^{2+}$掺杂型$Zn_{0.07}Fe_{2.93}O_4$纳米晶的吸波性能优于$Fe_3O_4$, 前者的最大吸收峰(-19.3 dB)大于后者(-9.8 dB), 且吸收峰低于-10 dB的峰宽达2.5 GHz.

关键词: 四氧化三铁; Zn1-xFe2+xO4; 纳米晶; 溶剂热; 电磁性能

# Solvothermal Synthesis and Electromagnetic Properties of $Fe_3O_4$ and Its $Zn^{2+}$-Substituted $Zn_{1-x}Fe_{2+x}O_4$ Nanocrystallines

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Abstract:

$Fe_3O_4$ and $Zn_{1-x}Fe_{2+x}O_4$ nanocrystallines were successfully prepared using NaAc as protective reagents via solvothermal method. The structure, size, morphology and chemical composition of the products were investigated in detail by X-ray diffraction(XRD) and scanning electron microscopy (SEM).The results indicate that the monodisperse nanocrystallines are nanospheres and the averaged size of $Zn_{0.07}Fe_{2.93}O_4$(70 nm) is smaller than that of $Fe_3O_4$(170 nm). The magnetic properties of the sample were investigated and revealed that the saturation magnetization(54.2 $A·m^2·kg^{-1}$) of $Zn_{0.07}Fe_{2.93}O_4$ nanocrystalline was smaller than that of $Fe_3O_4$(81.6 $A·m^2·kg^{-1}$). The electromagnetic performance and microwave adsorption efficiency of both nanocrystallines were measured by a vector network analyzer(VNA) technique in a frequency region 2—18 GHz. The results indicate that $Zn_{0.07}Fe_{2.93}O_4$ nanocrystallines exhibit better microwave adsorption efficiency. For example, the $Zn_{0.07}Fe_{2.93}O_4$ nanocrystalline, the reflection loss maxium is 19.3 dB, almost equal to the double values of $Fe_3O_4$ (9.8 dB), and the bandwidth with a reflection loss more than 10 dB is up to 2.5 GHz.

Keywords: Fe3O4; Zn1-xFe2+xO4; Nanocrystalline; Solvothermal; Electromagnetic property

收稿日期 2009-07-31 修回日期 网络版发布日期

DOI:

基金项目:

国家自然科学基金(批准号: 10672197)、湖南省杰出青年基金(批准号: 07JJ1001)和印刷工程国家特色专业(批准号: TS10433)资助.

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