

有机生色团/SiO₂-TiO₂二阶非线性光学杂化材料的研究

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摘要 以分散橙-3 (DO-3) 与 γ -缩水甘油氧与基三甲氧基硅烷 (KH-560) 反应得到的功能性生色团ASD为前体, 采用溶胶-凝胶 (sol-gel) 法使ASD与钛酸四正丁酯在酸性条件下共水解缩合, 合成了新型稳定的有机生色团/SiO₂-TiO₂杂化溶胶, 并对该溶胶体系的相图进行了研究。利用傅立叶红外 (FTIR)、透射电镜 (TEM) 和X射线能量色散谱仪 (EDS) 研究了杂化溶胶形成过程中的络合机理及溶胶形态。由一维刚性取向气体模型计算杂化材料膜的二阶非线性光学 (NLO) 系数 $\chi^{(2)}$ is 1.43×10^{-7} esu。差示扫描量热法 (DSC) 测得杂化材料的玻璃化温度 可达196

℃; 用紫外-可见光谱对杂化膜在极化前后的取向及取向稳定性进行了研究。

关键词 [杂化材料](#) [非线性光学](#) [取向](#) [稳定性](#) [偶氮染料](#) [硅烷 P](#) [溶胶-凝胶法](#)

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Organic Chromophore Group/SiO₂-TiO₂ Hybrid Material for Organic- Inorganic Second-Order Nonlinear Optics

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Abstract A new type of organic chromophore group/SiO₂-TiO₂ second-order nonlinear optical (NLO) materials has been obtained by sol-gel process from titanium butoxide [Ti(OBu)₄] and an alkoxy silane dye (ASD) synthesized by coupling disperse orange-3 (DO-3) with (3- glycidoxypropyl) trimethoxysilane (KH-560). The phase diagram of the system was investigated and a stable hybrid sol was prepared. Research by X-ray energy dispersion spectrum (EDS) and transmission electronic microscope (TEM) shows that the hybrid sol particles consist of SiO₂, TiO₂ and the organic chromophore group and the size of the particles is about 20~80 nm. Moreover the mechanism of the complexing reaction was also investigated by Fourier transform infrared spectrometer (FTIR) in the preparation process of the hybrid sol. The ordering parameter Φ of the transparent poled film of the hybrid material, prepared by spin-coating, thermal curing and corona poling at 190 °C for 1 hour, can reach 0.38 and the second-order nonlinear optical polarizability $\chi^{(2)}$ is 1.43×10^{-7} esu according to one dimensional rigid oriented gas model (1DROGM). The poled film exhibits good orientation stability and its glass transition temperature is 196 °C.

Key words [HYBRID MATERIALS](#) [NON LINEAR OPTICS](#) [ORIENTATION](#) [ORIENTATION](#) [AZO DYES](#) [SILANE P](#) [SOL-GEL PROCESS](#)

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