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研究论文

Y_2O_3/纳米碳管复合粒子的结构及其对高氯酸铵热分解性能的研究

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摘要 采用溶胶-凝胶法制备了Y_2O_3/纳米碳管复合粒子, 并用SEM, XPS, FT-IR和XRD对Y_2O_3/纳米碳管复合粒子的形貌和微观结构进行了表征. 结果表明, 纳米碳管有效承载了Y_2O_3, Y_2O_3连续均匀地负载在纳米碳管的表面, 负载量为19.53%. FT-IR 和XPS证明了Y_2O_3粒子和纳米碳管表面之间发生了化学键合. 用三种方法将相同比例的Y_2O_3/纳米碳管复合粒子与高氯酸胺(AP)进行混合, 采用差热分析(DTA)研究了三种混合样品中Y_2O_3/纳米碳管复合粒子对高氯酸铵热分解的催化性能. 结果表明, 三种混合样品中的Y_2O_3/纳米碳管复合粒子都能催化高氯酸铵的热分解, 其中通过水溶剂混合的样品中Y_2O_3/纳米碳管复合粒子的催化效果优于另外两种. 与纯高氯酸铵相比, 其样品中高氯酸铵的高温分解峰温降低了168.5 ℃, 表观分解热由371 J•g^{-1}提高到1410 J•g^{-1}. 并用不同样品中高氯酸铵热分解动力学参数对所得结果进行了理论分析.

关键词 溶胶-凝胶法 纳米碳管 Y_2O_3 Y_2O_3/纳米碳管复合粒子 高氯酸铵

分类号

Y_2O_3/Carbon Nanotube Composite Particles: Microstrcture and Catalytic Performance for Decomposition of Ammonium Perchlorate

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Abstract Y_2O_3/carbon nanotube composite particles were prepared by a sol-gel method. The microstrcture and looks of the composite particles obtained were characterized by SEM, XPS, FT-IR and XRD methods. The results indicate that Y_2O_3 are supported well on the surface of carbon nanotube. The Y_2O_3 particles coating on carbon naotube appear even and continous. This points to high nucleation density and big binding energy. FT-IR and XPS reveal that Y_2O_3 particles are coated with carbon nanotube through chemical bond. Three comparison samples mixing Y_2O_3/carbon nanoube composite particles with ammonia perchlorate (AP) by three mixing methods were prepared. And DTA experiments were used to characterize their catalytic performance. The results imply that the catalytic performance of Y_2O_3/carbon nanotube composite particles in the sample mixing by water phase is superior to that of the other. Compared with the pure ammonia perchlorate, the peak temperature of high temperature decomposition of AP in this mixing sample decreases 168.5 ℃, and the total heat release improves from 371 to 1410 J•g^{-1}. The kinetics parameters of the thermal decomposition of AP in different samples were investigated to explain the above results.

Key words sol-gel method carbon nanotube Y_2O_3 Y_2O_3/carbon nanotube composite particle ammonia perchlorate

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