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过渡金属氧化物和金属负载型沸石催化剂上合成 纳米碳管及其表征

张爱民,王仰东,谢德,郑静,鲍书林,须沁华

南京大学化学化工学院

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摘要 采用气相催化沉积法催化合成纳米碳管，比较了不同金属氧化物和金属负载型沸石催化剂以及不同分子筛载体对合成纳米碳管的影响，并用TEM，XRD表征其形貌和结晶度，用DTA-TG考察了纳米碳管的热和稳定性。实验结果表明纳米碳管的形成除了与金属种类有关外，还直接与催化剂的颗粒大小和分散状态有关。粒径在20nm左右的不规则形状的纳米粒子是形成纳米碳管的活性组分，非负载和负载型的催化剂均表明活性组分的粒径与纳米碳管的管径有一定的对应关系。化学提纯后能得到高纯度的纳米碳管；其管壁具有较好的石墨化结构，在空气中的热稳定性大于400℃，而在氮气中能维持到1200℃以上。

关键词 分子筛 纳米碳管 氧化物 催化剂 过渡金属化合物 透射电子显微术 X射线衍射分析

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Catalytic synthesis and characterization of carbon nanotubes on unsupported and zeolite-supported transition metal oxides catalysts

Zhang Aimin,Wang Yangdong,Xie De,Zheng Jing,Bao Shulin,Xu Qinhua

Abstract Catalytic synthesis of carbon nanotubes using chemical vapor deposition was studied in this work. The influences of supported and unsupported transition metal oxides on the formation of carbon nanotubes were investigated. The morphology of the as-prepared catalysts and the nanotubes formed on the corresponding catalyst was observed by TEM. The thermal stability of nanotubes was measured by DTA-TG. It was found that the formation of carbon nanotubes correlated not only with the kind of transition metal oxides employed but also with the size and dispersion degree of active metal particles. The irregular nanoparticles of active metal oxides were suitable for forming uniform carbon nanotubes. The Co-La catalyst with the diameter of ~20 nm was the most active one for the preparation of nanotubes. The particle size of the catalyst was found to be dependent on the diameter of nanotubes formed on both of the unsupported and zeolite-supported metal oxides. The transition metals supported zeolites were good catalysts for the growth of carbon nanotubes. The carbon nanotubes formed on zeolite-supported metal catalysts were cleaner than that those formed on unsupported metal oxides catalysts. The high purity of nanotubes that possess well- graphitized structure and good thermal stability can be obtained by further chemical treatment with nitric acid. They can maintain their structure at temperatures over 400℃ in air or over 1200℃ in a nitrogen atmosphere.

Key words MOLECULAR SIEVE OXIDE CATALYST TRANSITION METAL COMPOUND TRANSMISSION ELECTRON MICROSCOPY X-RAY DIFFRACTION ANALYSIS

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通讯作者