催化剂前驱体对碳纳米管生长影响的研究

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摘要　采用柠檬酸络合法, 通过改变La和Ni的摩尔比例获得了一系列的La-Ni-O催化剂前驱体, 以H_2作为还原气体, N_2为保护气体, C_2H_2为碳源, 采用化学气相沉积法制备碳纳米管(CNT). 用XRD研究所得催化剂前驱体还原前后的结构, TEM观察所得CNT的形貌. 结果发现: 在所制备的一系列La-Ni-O催化剂前驱体中, 具有催化活性的物质只有: $LaNiO_3$和La_2NiO_4. 但由$LaNiO_3$所制备的CNT的产率却大大高于由La_2NiO_4所制备的CNT的产率. 经分析认为, 这主要是与两者被还原后的产物中的纳米级金属Ni的(111)晶面含量有关, 纳米级金属Ni的(111)晶面含量和晶粒度越大, 其CNT的产率和内径也就越大.

关键词　碳纳米管　La-Ni-O　催化剂前驱体

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Effect of the La-Ni-O Catalyst Precursor on Carbon Nanotubes Growth

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Abstract A series of La-Ni-O compounds were synthesized with modifying the mol ratio of La to Ni by citric acid complexometry and used as the catalyst precursors to prepare carbon nanotubes (CNT) by the chemical vapor deposition method (CVD). At the same time, H_2, N_2 and C_2H_2 were used as the reduction gas, protection gas and carbon source gas, respectively. The structures of the catalyst precursors before and after reducing by H_2 were characterized by XRD and the patterns of the CNT obtained from the catalyst precursors were characterized by TEM. The results show that only chemical compounds $LaNiO_3$ and La_2NiO_4 in the series La-Ni-O catalyst precursors have the ability to prepare CNT. However, the yield of CNT from the catalyst precursor $LaNiO_3$ is greatly higher than that from the catalyst precursor La_2NiO_4. And the reason is that the content of nano-meter metal Ni (111) crystal face in the productions from $LaNiO_3$ after being reduced is higher than that from La_2NiO_4. That is to say the higher the content of nano-meter metal Ni (111) crystal face and the larger the grain size, the higher the yield of CNT and the larger the inner diameter of CNT.

Key words   carbon nanotubes   La-Ni-O   catalyst precursor

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