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论文

胶体铜催化丙烯腈水合的高选择性及其活性中心结构的研究

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摘要:

研究了胶体铜催化丙烯腈水合制丙烯酰胺的高选择性与活性中心结构的关系. 在聚乙烯吡咯烷酮(PVP)保护下, 用肼和氢氧化钠混合液还原CuCl2制得胶体铜, 用其催化丙烯腈水合反应, 选择性达到100%, 产生高选择性的原因如下: (1) 胶体铜的活性中心不是胶粒表面的点缺陷, 而是胶体铜颗粒表面的位错端点. (2) 由于胶体铜具有高硬度和高强度的力学特性, 保证了活性中心结构的稳定性; 胶体铜颗粒的平均粒径(45 nm)超过晶粒的特征长度, 进一步保证了活性中心的稳定性.

关键词: 胶体铜; 催化剂; 高选择性; 丙烯腈

High Selectivity and Structure of Active Centre of Copper Colloidal Catalyst in Selective Hydration of Acrylonitrile to Acrylamide

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Abstract:

The relationship between the high selectivity of catalysis and the structure of active centre of copper colloidal catalyst in selective hydration of acrylonitrile to acrylamide was studied. Colloidal copper particles were prepared by reducing copper(Ⅱ) chloride solution with the mixed solution of hydrazine hydrate and sodium hydroxide in the presence of stabilizer polyvinyl pyrrolidone(PVP). The copper colloids stabilized by PVP were used as the catalyst in selective hydration of acrylonitrile to acrylamide with a selectivity of 100%. Therefore, the character of colloidal copper catalyst is its high selectivity. According to the properties of defects on the surface of colloidal copper particles, the reasons of the high selectivity are analyzed: (1) The type of the active centre is singled. According to the theories of defect and experimental results, it is shown that the active centre of metal copper is not point defect, but the end point of dislocation. (2) The structure of the active centre is stable. The experimental results show that the colloidal copper particle have mechanical properties of high hardness and high strength, which keep the structure of active centre stability. Meanwhile, the size of the colloidal particles is 45 nm longer than that of particles, dislocation of which can exist stably. So the dislocation can exist stably on the colloidal copper particles. This further ensures the stability of the structure active centre. We also propose the view point that a proper size space is needed for active centre existing stably on the surface of the catalyst. This explains the reason that colloidal catalyst particles under a certain size will lose its catalytic activity.

Keywords: Colloidal copper; Catalyst; High selectivity; Acrylonitrile

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