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论文

超临界二氧化碳流体环境中导电聚吡咯复合材料的制备

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摘要:

以聚苯乙烯(PS)和锌盐中和的磺化聚苯乙烯(Zn-SPS)膜为基体, 在超临界二氧化碳(SC-CO_2)环境中用化学氧化法原位制备了聚吡咯(PPy)导电复合材料. 由于SC-CO_2对聚合物基体的强溶胀作用, 吡咯分子高效地扩散到基体内部进行聚合而形成导电通路, 得到比传统的水溶液法更高的电导率. 聚合物基体的性质对复合材料的导电性和形貌产生重要影响. 在相同条件下, Zn-SPS/PPy的电导率比PS/PPy高3~4个数量级, 而它们的体积逾渗阈值分别为2.7%和6.2%, 远远低于理论预测值(16%).

关键词: 超临界二氧化碳流体; 聚吡咯; 导电复合材料

Preparation of Conductive PPy Composites Under Supercritical Carbon Dioxide Circumstance

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Abstract:

Electrically conductive composites were prepared via the chemical oxidative polymerization of pyrrole monomer in polystyrene(PS) and zinc neutralized sulfonated polystyrene(Zn-SPS) films under supercritical carbon dioxide(SC-CO_2) circumstance. The strong swelling effect of SC-CO_2 made polypyrrole(PPy) particles not only formed on the surface, but also incorporated into the film, resulting in a homogenous structure and a relatively higher conductivity. By comparison, the composite prepared in aqueous solution shows a skin-core structure and a conductivity of 3 to 4 orders of magnitude lower than that of the former due to the diffusion controlled process of pyrrole monomer. The percolation thresholds of PS/PPy and Zn-SPS/PPy composites are 6.2% and 2.7% of volume fractions of PPy, respectively, much lower than a theoretically predicted value of 16%. Moreover, the conductive composites prepared under SC-CO_2 circumstance show higher thermal stability, especially in the high-temperature region.

Keywords: Supercritical carbon dioxide; Polypyrrole; Conductive composite

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