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论文

P(AMPS-co-BMA)水凝胶的电场敏感性及电刺激响应机理

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摘要:

以离子型单体2-丙烯酰胺-2-甲基丙磺酸(AMPS)及非离子型单体甲基丙烯酸丁酯为原料, 偶氮二异丁腈为引发剂, *N*,*N*′-亚甲基双丙烯酰胺为交联剂, *N*,*N*-二甲基甲酰胺为溶剂, 通过自由基聚合合成了一系列聚离子浓度不同的聚(2-丙烯酰胺-2-甲基丙磺酸-co-甲基丙烯酸丁酯)电场敏感性水凝胶. 研究了其在去离子水及NaCl溶液中的溶胀行为. 结果表明, 该水凝胶在去离子水中的平衡溶胀度在236.4~298.5之间, 其溶胀速率随着AMPS用量的增加而增加; 并且随着凝胶内部聚离子浓度的增加, 凝胶在NaCl溶液中的消溶胀速率及消溶胀度逐渐减小. 凝胶的电刺激响应性能研究结果表明, 在电场存在下, 凝胶在NaCl溶液中的溶胀行为与凝胶内部聚离子浓度和溶液中NaCl浓度的相对大小有关, 当凝胶内部聚离子浓度大于溶液中NaCl浓度时, 凝胶溶胀, 反之则凝胶消溶胀; 而且, 凝胶在电场作用下的偏转行为同样与凝胶内部聚离子浓度和溶液中NaCl浓度的相对大小有关, 当凝胶内部聚离子浓度大于溶液中NaCl浓度时, 偏向阴极, 反之则凝胶偏向阳极. 另外, 在电场存在下, 凝胶在NaCl溶液中的电偏转速度与环境温度密切相关.

关键词: 水凝胶; 电场敏感; 聚(2-丙烯酰胺-2-甲基丙磺酸-co-甲基丙烯酸丁酯)

Electric-sensitive Properties and Mechanism of P(AMPS-co-BMA) Hydrogels

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Abstract:

Electric-sensitive hydrogels[P(AMPS-co-BMA)] were prepared by free-radical polymerization with 2-acrylamido-2-methyl propyl sulfonic acid(AMPS) as ionic monomer and (BMA) as non-ionic monomer, using *N*,*N*′-methylene bisacrylamide as crosslinking agent, azobisisobutyronitrile as initiator and *N*,*N*-dimethyl formamide as solvent, respectively. The swelling properties of hydrogels in deionized water and in NaCl solution were studied in detail. The results show that the swelling rate of the hydrogels increases with the increasing content of AMPS, and the equilibrium swelling ratio of the hydrogels ranges from 236.4 to 298.5. In addition both the deswelling speed and the deswelling extent of the hydrogels decrease with the increasing concentration of polyion in inside of the hydrogels. Moreover, the electrical sensitivity of the hydrogels was studied. The swelling properties of the hydrogels in NaCl solution with an applied voltage were related to the ionic concentration difference between interior hydrogels and exterior NaCl solution. When the concentration of polyion in interior hydrogels is higher than the concentration of NaCl in solution, the hydrogels swells; contrarily, the hydrogels deswells. The bending direction of the hydrogels was also related to the ionic concentration difference between interior hydrogels and exterior NaCl solution. When the concentration of polyion in interior hydrogels is higher than the concentration of NaCl in solution, the hydrogels bend toward cathode; contrarily, the hydrogels bend toward anode. Further investigation shows that the bending speed of the hydrogels also depends on the temperature significantly.

Keywords: Hydrogel; Electrical sensitivity; Poly(2-acrylamido-2-methyl propyl sulfonic acid-co-butylacrylate)

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