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Polymer network pn junctions with ionic charge carriers

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In this work, new kind of pn junctions with ionic charge carriers were created via polymeric hydrogels. The polymer pn junctions were synthesized in two different ways. In the first way, p and n type doped polyacrylamide hydrogels were synthesized on the top of the other. The dopant molecules with positive and negative counter ions were bound chemically the polymer network during the synthesizing of these gels. In the second way, the pregel solution was prepared so as to include the dopant having both negative and positive counter ions together. This pregel solution was synthesized under an electrical field. In this case positively and negatively charged dopant molecules drift to opposite sides of the gel due to the external electrical field applied on the solution during the polymerization. The charged molecules bind randomly to the ends of the polymer strands and the cross link points of the network.[1, 2] The counter ions create the current under applied voltage when the gels were swollen in pure water that causes the counter ions to be free to move. The mobility of the counter ions of the dopants increases upon swelling of the gel and contribute to the current passing through the gel. The bonding kinetics of the charged molecules to the network was modeled and observed by the fluorescence measurements.[3] We demonstrate that these two junctions rectify considerably the electric current. [4] We have shown that some of the junction characteristics like doping concentration; threshold voltage etc. can be changed easily.

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 - [2] B. F. Senkal, et. al., *Polym. Adv. Technol.* **17**, 924 (2006).
 - [3] Kizildereli, N., et. al., *J. Appl. Polym. Sci.* **115**, 2455 (2009).
 - [4] E. Alveroglu, Y. Yilmaz, *Nanoscale Res. Lett.* **5(3)**, 559 (2010).