Multiresponsive Spiropyran-based Copolymer: Synthesis and characterization

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Photochromic copolymers carrying spiropyran side groups have attracted particular attention for potential applications in optical devices, photonic memory and photosensing, as well as, fluorescence imaging.\[1\] These materials allow overcoming many of the limitations inherent to traditional spiropyran doped polymers, such as, phase separation of the colorant and retardation of the decoloration of the open form.\[2\] The introduction of light sensitive moieties within responsive polymers has led to the development of sophisticated multiresponsive systems.\[3\] Block copolymers are important self-assembling systems that can assume a diversity of nanometer-scale morphologies due to the incompatibility and the connectivity constrains between the chemically distinct segments. Therefore, self-assembly of photochromic copolymers in the solid state or in solution allows the development of nanostructured materials.\[4\]

The aim of this research study is the synthesis of a multiresponsive spiropyran-based copolymer, poly(styrene)-co-poly(1',3',3'-trimethyl-6-methacryloyloxy Spiro(2H-1-benzopyran-2,2'-indoline)-4-vinylbenzoic acid) 2. The functionalized block copolymer poly(styrene)-block-poly(4-vinylbenzoic acid) (PSt-b-P4VBA) 1 synthesized by reversible addition fragmentation chain-transfer (RAFT) polymerization was coupled with 1,3,3-trimethyl-6-hydroxyspiro(2H-1-benzopyran-2,2'-indoline). The link between the functionalized block copolymer and spiropyran was successfully obtained by Steglich esterification using DMAP/DCC as catalysts (Scheme 1).

Scheme 1

Gel permeation chromatography (GPC) results confirmed the insertion of spiropyran units into the PSt-b-P4VBA copolymer (Figure 1). Photosensitivity properties of the newly synthesized copolymer 2 are very promising.


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