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A REVIEW ON THE PROGRESS OF POLYMER NANOSTRUCTURES WITH MODULATED MORPHOLOGIES AND PROPERTIES, USING NANOPOROUS AAO TEMPLATES.

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ABSTRACT

Polymers with the same chemical composition can provide different properties by reducing the dimension or simply by altering their nanostructure. The recent literature reports hundreds of examples of advanced methods in the fabrication of polymer nanostructures accomplished following a variety of approaches, such as soft lithography, self-assembly routes, template assisted methods, etc. Polymer nanostructures with modulated morphologies and properties can be easily achieved from Anodized Aluminum Oxide (AAO) template assisted methods. In the last decade, fabrication of polymer nanostructures in the nanocavities of AAOs has increased in interest since it allows the control and tailoring of the dimensions of a huge number of polymer and polymer-based composites materials. The fact that polymer dimensions may be adjusted allows the study of size-dependent properties. Moreover, using AAO template methods, modulated polymer nanostructures may be designed for specific applications. This review presents recent new insights in the fabrication methods of polymer nanostructures from hard porous AAO templates, with emphasis on the study of polymer structure/property relationships on the nanometric length scale, stressing potential interests in relevant applications. The discussion includes i) a description of the anodizing methods and strategies to obtain AAO templates with adjusted dimensions; ii) a summary of different infiltration methods, starting with the infiltration of a polymeric fluid (melt or solution) into the nanocavities of the AAO template, to conform a great number of the polymer nanostructures with different morphologies, the approach to obtain directly polymer nanostructures by in-situ polymerization of a monomer within AAO nanocavities and the affect of confinement in the AAO nanoreactor on the polymerization kinetics; iii) an overview of the effects of confinement on structural aspects, dynamical processes and the mechanical, thermal and rheological properties of the polymer; iv) examples of polymer nanostructures as precursors in bio-, adhesion, optical and electrical related applications; and finally v) a summary of conclusions and suggested challenges.

Keywords: anodized aluminum oxide, template assisted, nanoporus nanocavity, nanostructure, nanoreactor

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