Long-term efficiency for reducing entanglements of nascent polyethylene by a polystyrene modified Ziegler-Natta catalyst

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November 3, 2020

Abstract

The weakly entangled UHMWPE was synthesized by a Ziegler-Natta catalyst, where the titanium tetrachloride was anchored on the polystyrene (PS) modified silica. The PS chains were incorporated into silica pores through the in-situ free-radical polymerization of styrene. This incorporated PS was proved to be coated on the surface of pore walls. The self-diffusion coefficients and crystallization of probed molecules were investigated by the pulsed field gradient NMR and thermoporosimetry to address the swollen behavior of the coated PS phase. This swollen PS formed numerous horizontal isolators to compartmentalize the active sites and adjacent chains. The ubiquitous isolators effectively limited the formation of chains overlaps during the polymerization, showing a long-term efficiency to reduce the entanglements of nascent UHMWPE with an exceptional activity. The toughness/stiffness/strength balance of weakly entangled UHMWPE was significantly improved, since the enhanced chain diffusion rate limited the formation of forming defects.

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