Synthesis of Functionalized Stereoregular Poly(dienes)

Margaret Flook Vielhaber, Ph.D
Principal Scientist, Goodyear Tire & Rubber Co., Akron, OH
May 10th, 2018

Abstract

Synthetic rubber is commonly used in applications in which interaction with a polar matrix is beneficial, and the introduction of polar groups into the polymer can be used to improve this interaction. Styrene-butadiene rubbers and butadiene rubbers containing polar or reactive functionalities have been reported in the academic and patent literature, and select functionalized polymers are manufactured commercially today. Despite these advances in functionalization chemistry in synthetic rubber, there are still only a handful of viable techniques to prepare synthetic rubber that is both stereoregular and functionalized.

In this presentation, various novel approaches will be described for the preparation of cis or trans-polybutadiene and polyisoprene containing in-chain or end-group heteroatom functionality. In-chain functional cis-polydienes were prepared through copolymerization of functional dienes with butadiene or isoprene using nickel or neodymium catalysts. A synergetic effect was found in the polymerization of functionalized dienes of certain linker lengths wherein a polar functionality on the comonomer binds to the active catalyst site, enhancing its incorporation into the growing polymer chain. In addition, heterotelechelic trans polybutadienes and polyisoprenes were prepared by using functionalized alkyl magnesium reagents combined with copolymerization of functional dienes and quenching with functional terminators.