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Refining Chlorosulfonation Methods for the Synthesis of a Perfluoroalkyl Arylsulfonimide (PFSI) Monomer

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Abstract

Proton-exchange membrane (PEM) fuel cells are sources of energy that are clean, quiet, and highly responsive to changes in power needs, making them promising for use in automobiles and other portable power devices. The electrolyte of a PEM cell–the layer responsible for conductivity–is a polymer membrane, commonly consisting of perfluoroalkyl sulfonic acid (PFSA) polymers. Perfluoroalkyl arylsulfonimide (PFSI) polymers are expected to improve the efficiency of PEM fuel cells through optimal stability and proton conductivity. The trifluovinylether (TFVE) aryl perfluorosulfonamide monomer is a new PFSI monomer proposed to fulfill these benefits once polymerized. A six-step synthesis route was initially designed to prepare this monomer. For time and cost benefits, we changed to a 5 step-synthesis that uses a starting material that is commercially available and also eliminates a challenging reaction step and tedious purification procedure.

The new starting material was brominated first to protect the trifluorvinyl ether double bond. Our research focused on performing the subsequent chlorosulfonation reaction according to methods in the literature. Through reflux, filtration, and drying, the crude chlorosulfonation product was obtained for multiple trials but requires further purification and characterization.