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Synthesis, Characterization, and Thermoelectric Properties of Radical Siloxanes

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Abstract

More than half of the annual energy consumption in the United States is lost as waste heat. Polymer-based thermoelectric devices have the potential to utilize this waste heat both sustainably and cost-effectively. Although conjugated polymers currently dominate research in organic thermoelectrics, the potential of using polymers with radical pendant groups have yet to be realized. These polymers have been found to be as conductive as pristine (i.e., not doped) poly(3-hexylthiophene) (P3HT), a commonly-used charge-transporting conjugated polymer. This could yield promising avenues for thermoelectric material design as radical polymers are more synthetically tunable and are hypothesized to have a high Seebeck coefficient. In this report, the compound 4,4,5,5-tetramethyl-2-(3-vinylphenyl)imidazolidine-1,3-diol was synthesized and then used to produce a polymer with a radical pendant group. A polysiloxane backbone was synthetically targeted to produce a material with a low glass transition temperature. The polymer is then characterized for its material and thermoelectric properties.