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Synthesis and Characterization of Perfluorinated Polyimide/Silica Hybrid Materials via Sol-Gel Process for Photonic Applications

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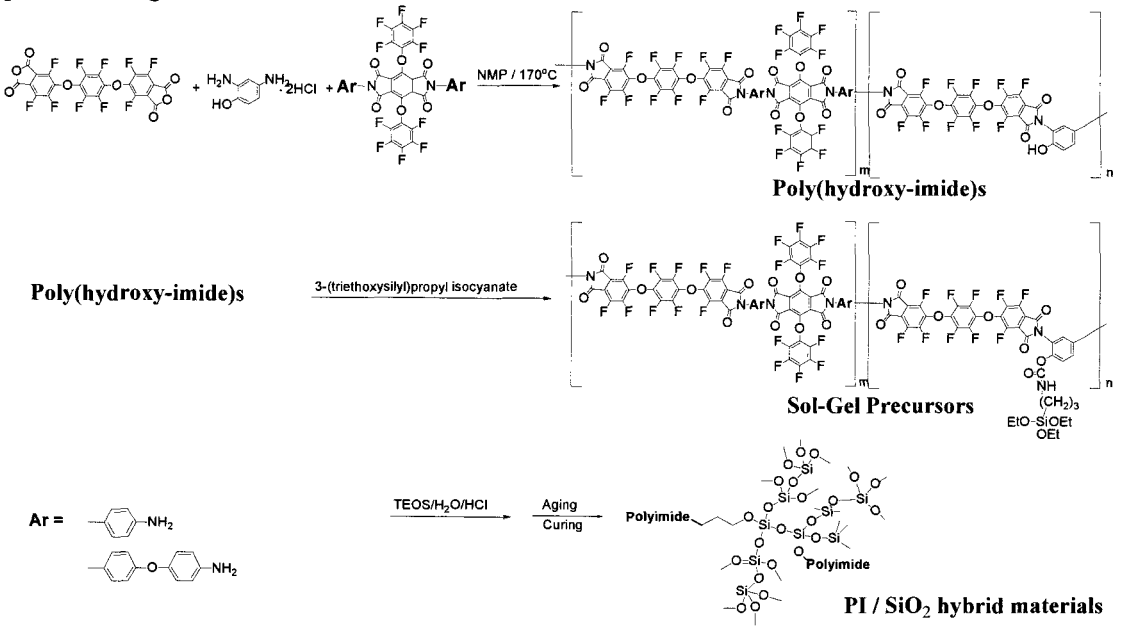
Recently, we successfully developed the new synthetic routes to diamines with pendant bulky perfluorinated aromatic units in a multi-step synthetic procedure. Poly(hydroxyl-imide)s were then prepared by using novel fluorinated new diamins with 3-D controlled structure and perfluorinated dianhydride, as shown in Scheme 1. Further, we achieved the coupling reaction of poly(hydroxyl-imide) with 3-(triethoxysilyl)propyl isocyanate in DMAc, yielding sol-gel precursors. Using the present sol-gel precursors, a series of polyimide-silica hybrid materials for planar waveguide materials were prepared with TEOS by hydrolysis and polycondensation in the presence of a slight excess amount of acidified water (pH3). The hybrid precursors were spin-coated on various substrates such as silicon wafer or NaCl disc, etc. Hybrid films were further polycondensed by curing at 200 °C for 3h. The chemical identification of the present hybrid materials was achieved by ^{1}H-, ^{19}F-NMR and ^{29}Si-NMR spectroscopies as well as FT-IR spectroscopies. All of the cured polyimides-silica hybrid films are transparent. The polyimides-silica hybrid materials were quite stable at elevated temperatures above 350 °C. Also, the hybrid materials offer the possibility of combining the advantages and overcoming the disadvantages of the two different materials of polyimides and silica. In this presentation, the synthesis, characterization and optoelectronic properties of the resultant polyimides-silica hybrid films for planar waveguide materials will be discussed.



Scheme 1. Synthetic routes to poly(hydroxyl-imide)s and polyimide-silica hybrid materials.

References

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