Polythiophene

Subjects: Polymer Science

Contributor: Jack Zhong

Polythiophene is a conjugated polymer built from thiophene rings linked at the 2- and 5-positions. The overlap of the pi orbitals along the chain gives it an extended conjugation, and oxidation or reduction produces mobile charge carriers [1]. The unsubstituted polymer is insoluble and infusible, so alkyl side chains are attached to the 3-position to make it processable [2]. The regioregularity of those side chains controls how the chains stack, and a head-to-tail arrangement gives the highest conductivity [3]. Doping shifts the absorption from the visible into the near infrared, which underlies the electrochromic behaviour [4]. The conductivity falls on exposure to air because the doped state is oxidatively unstable, so encapsulation is needed for a stable device [5].

conjugated polymer | thiophene ring | regioregularity | doping | electrical conductivity | alkyl side chain | electrochromism

References

1. Zotti, G.; Salmaso, R.; Gallazzi, M.C.; Marin, R.A. In Situ Conductivity of a Polythiophene from a Branched Alkoxy-Substituted Tetrathiophene. Enhancement of Conductivity by Conjugated Cross-Linking of Polymer Chains. *Chemistry of Materials* **1997**, *9*, 791-795. [CrossRef]
2. Thanasamy, D.; Jesuraj, D.; Konda kannan, S.K.; Avadhanam, V. A novel route to synthesis polythiophene with great yield and high electrical conductivity without post doping process. *Polymer* **2019**, *175*, 32-40. [CrossRef]
3. Li, W.; Wang, X.; Zhang, B.; Chen, Y. In Situ Modification of Multi-Walled Carbon Nanotubes with Polythiophene-Based Conjugated Polymer for Information Storage. *Materials* **2023**, *16*, 908. [CrossRef]
4. Fabre, B. Trifluoroborate-substituted polythiophene as a novel conjugated polymer promising for sensing and solid-state reactions. *Electrochemistry Communications* **2001**, *3*, 549-552. [CrossRef]
5. Bredas, J.L.; Heeger, A.J. Theoretical investigation of gas-phase torsion potentials along conjugated polymer backbones: polyacetylene, polydiacetylene, and polythiophene. *Macromolecules* **1990**, *23*, 1150-1156. [CrossRef]

Retrieved from https://encyclopedia.pub/entry/history/show/135590