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Electrochemically driven molecular rotors based on ferrocene-1,1'-diyl-bisphosphinic acids

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Abstract

© 2015, Pleiades Publishing, Ltd. Based on ferrocene-1,1'-diyl-bisphosphinic acids $\text{Fc}[\text{P}(\text{R})(\text{O})\text{OH}]_2$ ($\text{R} = \text{H}, \text{Me}, \text{Et}, \text{Ph}$) in methanol, two types of electrochemically driven molecular rotors are developed. Monoanions of acids are fixed in the cis-conformation due to the presence of an intramolecular hydrogen bond, whereas dianions are fixed in the trans-conformation due to electrostatic repulsion forces. Upon the transformation of monoanions to dianions, the controlled rotation of cyclopentadienyl rings from cis to trans-conformation occurs; the reverse switching leads to the reverse rotation. In one type of rotors, the rotation is controlled by the reversible variation of the solution pH and composition in the electrochemical oxidation-reduction cycle of N-phe-nyl-N'-isopropyl-1,4-phenylenediamine; in the other type, the rotation is determined by the one electron oxidation-re-reduction of the ferrocene nucleus in monoanions. The latter rotor type at room temperature can operate stably only for a short time ($\tau < 1$ s) and at longer times is irreversibly destructed during the oxidation stage.

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Keywords

electrochemistry, ferrocene-1,1'-diyl-bisphosphinic acid, molecular rotor, oxidation, pH switching