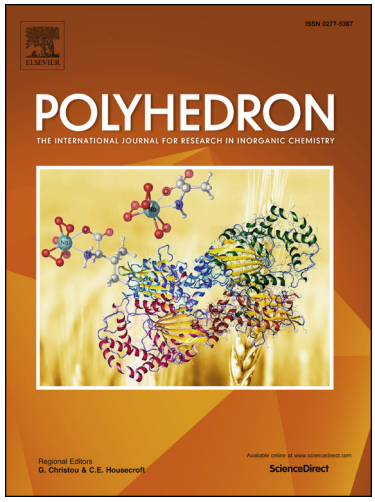

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Electrochemical characterization of Polypyridine Iron (II) and Cobalt (II) complexes for organic redox flow batteries

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Abstract

The electrochemical properties of a series of complexes based on chelate ligands were explored with the aim of finding promising candidates for applications in high voltage organic flow cells. The combination of Co(II)/(I) and Fe(III)/(II) as the cathodic and the anodic couple leads to open circuit voltages close to 2 V and to limiting current of the order of 30 mA/cm^2 in 0.3 M concentration in a mixture of Ethylene and Propylene Carbonates. The best solubility was found for bis-cationic complexes as triflate (OTf) salts, reaching > 0.6 M at room temperature. Potentiostatic and potentiodynamic experiments point to a substantial chemical and electrochemical stability at carbon based electrodes as well.

1.Introduction

Redox flow batteries are attractive devices in the framework of the storage of renewable energies in stationary power plants, which could be sized for both domestic and industrial applications ranging from kW to MW size [1]. In these conditions their main limitation, i.e. low energy density, relatively large volume, poor portability are relatively unimportant [2]. Their fundamental operation is relatively straightforward: in the charge phase the current generated by the solar power plant converts two redox couples (or the same redox species with at least two distinct redox states) in their respective oxidized and reduced form, which are stored in separate compartments. In the discharge phase, the battery operates the reverse reaction, i.e. the reduced and oxidized forms are restored to their initial state supplying current to the external load [1]. Among liquid flow-batteries, Vanadium redox flow-batteries are nowadays established prototypes in phase of advanced