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Electron Responsive Viologen-Based Supramolecular Gels

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In a nutshell, a gel is a material in which a large amount of solvent is trapped in a molecular network. In supramolecular gels, self-assembly of the network is achieved by non-covalent interactions (π - π stacking, H-bonding, ion pairing, solvophobic forces...) between low molecular weight gelators (LMWGs). Unlike polymeric gelators LMWGs have a well-defined chemical structure, offering the possibility to tune the material properties at the molecular level [1]. Stimuli responsive self-assembled molecular materials are capable of changing their organization in response to various stimuli (pH, T, P, magnetic field, light...). Such responsiveness has been proved useful in numerous fields such as catalysis, smart materials, pollutant removal, drug delivery system, development of sensors and memory devices [2]. However little examples of electro-responsive supramolecular materials are to be found in the literature [3]. The potential of such materials has recently been demonstrated through the development of a gel-based memristor exploiting conductivity changes associated to a sol/gel transition triggered by heating or DC bias [4]. Viologens carry much interest for the development of new functional materials and have already shown promising results for applications in molecular electronics [5]. We have recently reported a supramolecular metallo-gel able to undergo a gel-sol transition triggered by photo-reduction of its viologen moiety [6][7][8]. In the wake of this promising result a previously described viologen based gelator [9] has been synthesized and its gelation conditions have been investigated. Rheological and absorbance spectroscopy measurements have shown that the gel properties were strongly dependent on the ionic composition of the solvent, allowing the design of translucent and conductive gels. First photoreduction trials have shown that the viologen based gelator could be photoreduced in its gel state, giving a blue coloration to the material. A home-made cell allowing multi-characterization of the gel redox-responsiveness is currently under development and has shown promising results for the study of the gel electro-responsiveness.

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