Spectrally Selective PANI/ITO Nanocomposite Electrodes for Dual Band Dynamic Windows

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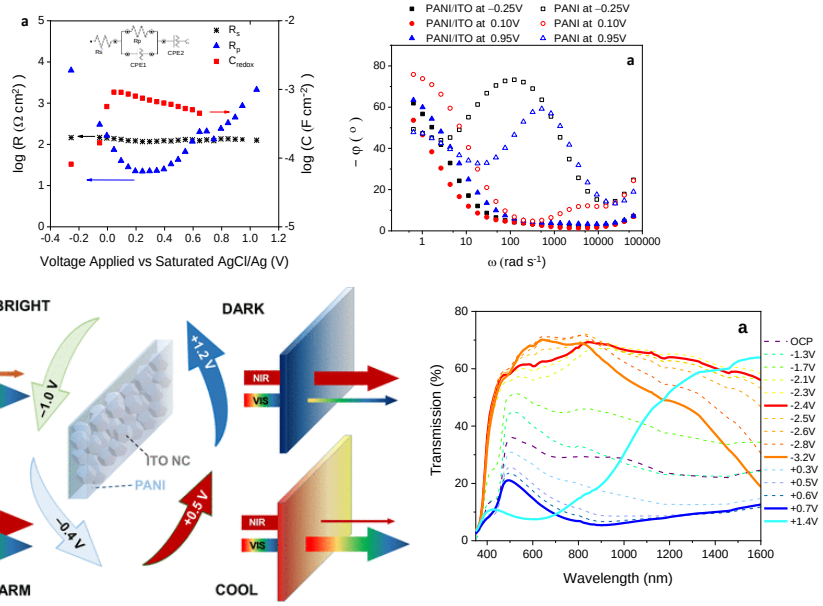
Chromogenic materials are able to change their optical properties as a response to an external stimulus, such as light irradiation (photochromic materials), temperature variation (thermochromic materials) or electric potential (electrochromic materials).

Glazing employing electrochromic materials can change their optical characteristics of transparency and absorption of solar radiation according to users' needs by simultaneously reducing visible light and NIR transmission through the window. However, spectral selectivity has been becoming a key requirement in smart dynamic windows as it permits maximizing both visual and thermal comfort while minimizing energy consumption for heating, cooling, and lighting [1].

Herein, a dual band electrochromic system is presented, which consists of an engineered nanocomposite electrode capable of advantageously combining the broad band plasmonic response of nanocrystalline indium-tin-oxide (ITO) with high optical contrast of polyaniline (PANI). Their synergistical spectroelectrochemical features make possible the implementation of a four-state tunable electrochromic system (here referred to as "plasmochromic"), which permits selectively regulating optical transmittance in the visible and near-infrared range and exhibits excellent spectral selectivity across a potentials window of only 1.2 V, with a visible light *vs.* solar transmittance ratio tunable from 0.67 to 1.61.

Electrochemical and spectroscopic features of the two constituting components (*i.e.*, ITO nanocrystals and PANI) will be discussed, together with the study of how their single characteristics symbiotically combine each other in defining the performance of the resulting hybrid plasmochromic electrodes. Finally, a set of dual-band EC devices offering an excellent VIS/NIR spectral selectivity within a relatively small electrochemical window will be presented, discussing their main key features [2].



References

[1] F. Pacheco-Torgal, S. Jalali, *Constr. & Build. Mater.*, 25 (2011) 582.

[2] P. Yilmaz, M. Magni, S. Martinez, R.M. Gonzalez Gil, M. Della Pirriera, M. Manca, *ACS Appl. Energy Mater*. 3 (2020) 3779.