Electrochemical Stability of Polypyrrol-Based Supercapacitors Containing Acid Blue 25

T. Hix-Janssens*, D. V. Tumacder, P. Bober

Institute of Macromolecular Chemistry, Czech Academy of Sciences, Prague, Czech Republic
**hixjanssens@imc.cas.cz*

Organic dyes, such as Acid Blue 25 (AB) positively influences the electrochemical and morphological properties of polypyrrole (PPy) [1, 2]. These research results can be further used to develop more efficient and flexible supercapacitors. Within this work, electropolymerization of pyrrole occurred on activated carbon cloths in the presence of AB concentrations between 0.625 and 2.5 mM. They were prepared using chronoamperometry with an applied potential of 1.5 V or 2.0 V for 20 min and 15 min, respectively. Calculated areal capacitances between all samples with AB and neat PPy were similar. However, the PPy containing AB showed a higher cyclic stability in both cyclic voltammetry and galvanostatic charge-discharge measurements. With an applied potential of 2.0 V during electropolymerization, the areal capacitance (C_A) after 1000 cycles of PPy decreased by 39% of the original value. In comparison, the C_A of those that included AB during the polymerization process decreased by 12-27%. Additionally, the effect of AB on the morphology of PPy on the carbon cloths was investigated using scanning electron microscopy. Samples containing only PPy showed the typical globular structure, while those containing AB showed the formation of fibrous structures. Increasing the applied potential and the concentration of AB during electropolymerization increased the count of these structures. These results show the promising nature of how organic dyes can positively affect the electrochemical properties of pyrrole to pave the way towards flexible and stable supercapacitors.

Keywords: supercapacitors, polypyrrole, acid blue, chronoamperometry

References

[1] Tumacder D. V., Morávková Z., Konefał M. *et al.*, Materials Research Bulletin. 168:112455, **2023**.
[2] Tumacder D. V., Morávková Z., Bober P., Materials Letters, 308:131295, **2022**.