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Hybrid materials consisted of electroactive polymers and inorganic redox network for energy conversion and storage devices

Hybrid materials based on electroactive polymers and inorganic compounds having transition metal redox centres are broadly recognized as a solution of technological importance for different type of energy conversion and storage tools. These materials have been applied as i.e. electrodes in batteries, electrochemical capacitors, fuel cells, solar cells.

One of the possibilities is combining poly (3,4-etylenedioxythiophene) (pEDOT) with metal (Co, Ni, Fe) hexacyanoferrate (MehcFe). New synthesis method has been elaborated. The method is based on electrochemical polymerization of EDOT followed by synthesis of inorganic network of Prussian Blue analogues inside polymer pEDOT matrix. Such procedure requires a presence of the Fe(CN)63+/4+ counter-ions inside pEDOT. The counter-ions during multicyclic polarization of the film in contact with an appropriate electrolyte react forming solid MehcFe network [1, 2]. The x-ray absorption techniques such as XPS and EXAFS proved existence of direct chemical interaction between organic polymer and inorganic part of the hybrid. Due to this chemical interaction realized via Fe-S bond new materials are not only a composite but they form a uniform in a nanoscale hybrid system. Both components of the films were found to enhance an electrode electric capacitance in comparison with capacitance of a pure polymer and a pure MehcFe film separately. [3].

The redox centres of the inorganic network were identified using electrochemical polarization methods. The iron atoms coordinated by carbon from -CN groups undergo reversible oxidation/ reduction at the potential range depending on the type of the second metal atom (Fe, Co, Ni) in the inorganic network. The second metal centre coordinated by nitrogen is active in a faradaic process for pEDOT/FehcFe and pEDOT/NihcFe. Activity of the films in non aqueous electrolytes was tested in respect to their potential application in symmetric or asymmetric supercapacitors or/and lithium batteries [2, 4].

[1] A. LISOWSKA-OLEKSIAK, A. P.NOWAK., V. JASULAJTIENE , *Poly(3,4-ethylenedioxythiophene)-prussian blue hybrid material: evidence of direct chemical interaction between PB and pEDOT*, Electrochemistry Comm. - Vol. 8 (2006) 107-112
[2] A. LISOWSKA-OLEKSIAK, A. P.NOWAK,. *Metal heksacyanoferrate network synthesized inside polymer matrix for electrochemical capacitors,* J. Power Sources. - Vol. 173 (2007)829-836
[3] A. LISOWSKA-OLEKSIAK, A. P. NOWAK. *Impedance spectroscopy studies on hybrid materials consisting of poly(3,4-ethylenedioxythiophene) and iron, cobalt and nickel hexacyanoferrate*, Solid State Ionics, Vol. 179 (2008), 72-78
[4] M. Wilamowska, A. Lisowska-Oleksiak, *Hybrid electrodes in non-aqueous systems, Journal of Power Sources*, .doi:10.1016/j.jpowsour.2009.01.003 2009.

Der Vortrag findet um **16:15** im Gebäude der Materialwissenschaften, Lichtwiese, Petersenstr. 23, **Raum 77** statt