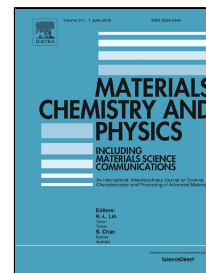


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## Electrochemical properties of lignin/polypyrrole composites and their carbonized analogues

Patrycja Bober<sup>a,\*</sup>, Nemanja Gavrilov<sup>b</sup>, Adriana Kovalcik<sup>c,d</sup>, Matej Mičušík<sup>e</sup>, Christoph Unterweger<sup>c</sup>, Igor A. Pašti<sup>b</sup>, Ivana Šeděnková<sup>a</sup>, Udit Acharya<sup>a,f</sup>, Jiří Pflieger<sup>a</sup>, Sergey K. Filippov<sup>a</sup>, Jaroslav Kuliček<sup>e</sup>, Mária Omastová<sup>e</sup>, Stefan Breitenbach<sup>c</sup>, Gordana Ćirić-Marjanović<sup>b</sup>, Jaroslav Stejskal<sup>a</sup>

<sup>a</sup>*Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, 162 06 Prague 6, Czech Republic*

<sup>b</sup>*University of Belgrade - Faculty of Physical Chemistry, Studentski trg 12-16, 11158 Belgrade, Serbia*

<sup>c</sup>*Kompetenzzentrum Holz GmbH, Competence Centre for Wood Composites and Wood Chemistry (Wood K Plus), A-4040 Linz, Austria*

<sup>d</sup>*Department of Food Science and Biotechnology, Faculty of Chemistry, Brno University of Technology, Purkynova 118, 612 00 Brno, Czech Republic*

<sup>e</sup>*Polymer Institute, Slovak Academy of Sciences, 845 41 Bratislava, Slovak Republic*

<sup>f</sup>*Faculty of Mathematics and Physics, Charles University, 121 16 Prague 2, Czech Republic*

### ABSTRACT

Lignin/polypyrrole composites were prepared by single-step coating of water-insoluble Kraft lignin with polypyrrole. The polymerization of pyrrole was performed with and without the presence of methyl orange, leading to the formation of polypyrrole films of two different morphology, globular and nanotubular, respectively, on the lignin surface. Such composites were converted to double-carbon composites enriched in nitrogen atoms by pyrolysis in nitrogen atmosphere at 650 °C. The carbonization process was followed by thermogravimetric analysis and confirmed by Raman spectroscopy. The properties of all composites were investigated by FTIR spectroscopy, XPS, EPR, SEM, specific surface area and electrical conductivity measurements. Electrochemical properties were analyzed in terms of their capacitive behavior mainly in acidic solutions, but also in neutral and alkaline media.

**Keywords:** polypyrrole, lignin, composites, carbonization, electrochemical properties

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