



# COIN2022

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## CONTEMPORARY BATTERIES AND SUPERCAPACITORS

INTERNATIONAL SYMPOSIUM  
BELGRADE 2022

## PROGRAM AND BOOK OF ABSTRACTS

June 1-2, 2022,  
Serbian Academy of Sciences and Arts  
Belgrade, Serbia

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## Al-ions Charge Storage Ability of the Conductive Polyaniline Emeraldine Salt

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Development of new and attractive generation of polymer devices for application in the field of energy storage that meets the requirements of safety and environmental sustainability is an ongoing challenge. The majority of previous scientific results reported that polyaniline-based supercapacitors use only aqueous acid solutions as electrolyte. [1] The aim of this work is to examine the redox activity of polyaniline emeraldine salt (PANI-ES) in an aqueous electrolyte of aluminum salt, that have been studied to a lesser extent and lacking the characterization of charge storage behavior. The advantage of employing aluminum among various post-lithium rechargeable systems has the advantage in the fact that it is the most abundant metal element in the Earth's crust with one of the highest gravimetric and volumetric energy densities. By combining experimental (cyclic voltammetry, chronopotentiometry, galvanic charge/discharge, AFM - Atomic Force Microscopy) and theoretical approaches (density functional theory - DFT), the redox mechanism of polyaniline in the aqueous Al-salt solution is explained. [2] Polyaniline has been shown to have higher Coulombic capacitance at the same charge and discharge current in aqueous aluminum nitrate solution (1M Al(NO<sub>3</sub>)<sub>3</sub>) than in hydrogen chloride electrolyte solution (1M HCl), which makes it a suitable electrode for supercapacitors. From a practical point of view, a supercapacitor based on polyaniline and an aqueous solution of Al(NO<sub>3</sub>)<sub>3</sub> was constructed and tested in terms of capacitance, cycle time, and self-discharge. The capacitor shows high charge and discharge capacity ( $\approx 269 \text{ F g}^{-1}$  at a current density of  $10 \text{ A g}^{-1}$ ) and relatively good capacity retention after 1000 charge and discharge cycles.

### References:

- [1] B. Kuzmanović, M.J. Vujković, N. Tomić, D. Bajuk-Bogdanović, V. Lazović, B. Sljukić, N. Ivanović, S. Mentus, The influence of oxygen vacancy concentration in nanodispersed non-stoichiometric CeO<sub>2- $\delta$</sub>  oxides on the physico-chemical properties of conducting polyaniline/CeO<sub>2</sub> composites, *Electrochim. Acta* 306 (2019) 506–515.
- [2] M. J. Vujković, M. Etinski, B. Vasić, B. Kuzmanović, D. Bajuk-Bogdanović, R. Dominko, S. Mentus, Polyaniline as a charge storage material in an aqueous aluminum-based electrolyte: Can aluminum ions play the role of protons? *Journal of Power Sources* 482 (2020) 228937.

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### Sponsors



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*The scientific man does not aim at an immediate result. He does not expect that his advanced ideas will be readily taken up. His work is like that of the planter — for the future. His duty is to lay the foundation for those who are to come, and point the way. He lives and labors and hopes.*

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**Nikola Tesla**



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