

DEVELOPMENT OF PYROCHLORE BASED NANO-STRUCTURED CERAMIC MATERIALS FOR ELECTROCHEMICAL SUPERCAPACITORS

Electrochemical supercapacitors are prominent power sources of today, which store and release energy by reversible adsorption and desorption of ions at the interfaces between electrode materials and electrolytes. Nano-structured pyrochlore ceramic materials are assumed to be promising candidates of electrode materials for super capacitors, because of electrical conductivity, electroactive sites, thermal stability, flexibility, specific capacitance, and cycling stability. In this work, we will examine the use of ceramic pyrochlore nanostructures to construct electrode materials for supercapacitors. Synthesized materials will be analyzed by X-ray diffraction (XRD), Scanning electron microscope (SEM), Fourier transform infrared (FT-IR) spectroscopy, Energy dispersive X-ray analysis (EDAX) and High-resolution transmission electron microscopy (HR-TEM). The electrochemical properties of the electrode materials will be studied by cyclic voltammetry(CV), galvano-static charge/discharge and electrochemical impedance spectroscopy.

References:

1. A. Shanmugavan, C. Sanjeeviraja, R. Kalai Selvan, Nanocrystalline pyrochlore $\text{La}_2\text{Sn}_{1.6}\text{Zr}_{0.4}\text{O}_7$ as a new candidate for supercapacitor electrodes, *Journal of Nanoscience and Nanotechnology*, 15 (4), 2015, pp. 2790-2797, <https://doi.org/10.1166/jnn.2015.9228>
2. P. Tang, Y. Cao, H. li, M. Lu, W. Qiu, The preparation of high-performance aqueous supercapacitor with high-entropy pyrochlore-type electrode and super-concentrated electrolyte, *Ceramics International*, 48 (2), 2022, pp. 2660 – 2669, <https://doi.org/10.1016/j.ceramint.2021.10.050>
3. Y. Cao, P. Tang, W. Qiu, T. Zhao, Preparation of Y-Doped $\text{La}_2\text{Ti}_2\text{O}_7$ flexible self-supporting films and their application in high-performance flexible all-solid-state supercapacitor devices, *ACS Omega* 2020, 5 (46), 2020, pp. 29722–29732, <https://doi.org/10.1021/acsomega.0c03402>
4. P. Tang, Y. Cao, W. Qiu, Preparation and properties of an ultrahigh-energy-density aqueous supercapacitor with a superconcentrated electrolyte and a Sr-modified lanthanum zirconate flexible electrode, *ACS Omega*, 6 (38), 2021, pp.24720–24730. <https://doi.org/10.1021/acsomega.1c03486>

5. S. S. Won, H. Kim, Jinkee Lee, C. K. Jeong, , S.-H. Kim, A. I. Kingon, Lead-free bismuth pyrochlore-based dielectric films for ultrahigh energy storage capacitors, *Materials Today Physics*, 33, 2023, pp. 101054, <https://doi.org/10.1016/j.mtphys.2023.101054>