5th International Workshop on Functional Nanostructured Materials (FuNaM-5)

September 24th – 26th, 2025, Krakow, Poland

Investigation of electrochemical properties of ceria-based supercapacitors

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INTRODUCTION

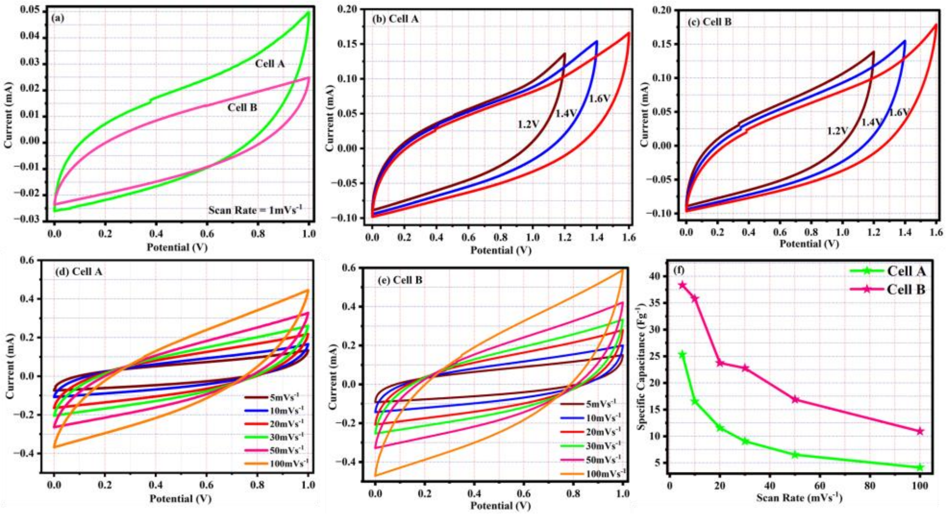
Supercapacitors are extremely essential for the near-sustainable future, with their very high power density, fast charging and discharging rates. Cerium (Ce)-based materials are good candidates for electrode materials. They offer unique redox properties and very high theoretical capacitance. The multiple oxidation states of cerium ($Ce^{3+}$and Ce^{4+}) allow for the Faradaic reactions and hence improve energy density [1]. Further improvements in electrical conductivity and stability, warrant diverse applications in electrochemical energy storage [2].

EXPERIMENTAL

A two-electrode configuration was employed, where GPEs were sandwiched between two symmetrical ceria-based electrodes, were used to prepare the investigated cells. Below, there are the details of cell configurations: Cell A: Pure CO(Pure Cobalt)|PVdF-HFP-$LiClO_4$|CO(Pure Cobalt) and Cell B: 20% Co-Cp(Cobalt doped Ceria)| PVdF-HFP-$LiClO_4$ | 20% Co-Cp (Cobalt doped Ceria).

RESULTS AND DISCUSSIONS

Cell B reveals enhanced electrochemically properties compared with Cell A. Both cells exhibit a capacitive behavior typical of charge storage in a non-Faradaic sense [3]. While the specific capacitance of Cell A is about 25.3 F g^{-1}, Cell B achieved 38.3 F g^{-1}. This means that Cell B demonstrates better charge storage, thus qualifying it to be a better supercapacitor. Moreover, both cells show good rate capability.



(a) CV curves of Cell A&B at scan rate of 1 mV s^{-1} (b, c,d,e) CV curves of Cell A&B at fixed scan rate (5 mV s^{-1}) and variable voltage from 0 V to 1.6 V and (f) variation of specific capacitance of Cell A&B with respect to scan rates.

REFERENCES

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