Synthesis and Characterization of MoB Electrode Material for Electrochemical Energy Storage

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Supercapacitors have emerged as promising energy storage devices due to their high power density, rapid charge-discharge capabilities, and long cycle life [1,2]. To further improve their performance, extensive research has focused on developing new electrode materials. Recently, metal borides have gained considerable attention as potential electrode materials for supercapacitors due to their unique properties, such as high electrical conductivity, excellent chemical stability, and large specific surface area [3].

Several synthesis methods of inorganic nanomaterials include sol-gel, combustion, hydrothermal, solvothermal, sonochemical, coprecipitation, and molten salt, etc. Among these methods, the molten salt method has emerged as a powerful, eco-friendly alternative for the synthesis of metal borides. The major advantages of molten salt method are low costs, low vapor pressures, high thermal stabilities, non-toxicity, and non-flammability [4,5].

This study aimed to explore the potential of MoB, a type of transition metal boride, as a new and high-performance electrode material for supercapacitors. The synthesis of MoB powders was accomplished using a borothermal process with the assistance of molten salt. The starting materials included Mo powder and amorphous B powder. The synthesis process was carried out under specific conditions: a temperature of 850°C, a duration of 4 hours, and an N_2 atmosphere. The phase transformation of the materials was assessed using X-ray diffraction (XRD), while scanning electron microscopy (SEM) and transmission electron microscopy (TEM) were employed to examine the morphology of the materials. The tests of electrochemical performance of MoB electrode in 1 M $NaSO_3$ electrolyte revealed that MoB has a strong potential as electrode material for supercapacitors.

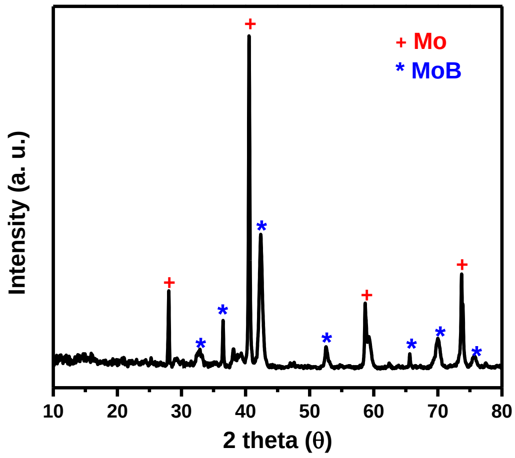

Fig. 1. XRD spectra of MoB.

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References

[1] B. Üstün, H. Aydın, S. Naci Koç, Ü. Kurtan, Fuel. 341 (2023) 127735.
[2] H. Aydın, U. Kurtan, M. Demir, S. Karakuş, Energy and Fuels. 36 (2022) 2212–2219.
[3] H. Chen, X. Zou, Inorg. Chem. Front. 7 (2020) 2248–2264.
[4] S.K. Gupta, Y. Mao, J. Phys. Chem. C. 125 (2021) 6508–6533.
[5] N. Díez, A.B. Fuertes, M. Sevilla, Energy Storage Mater. 38 (2021) 50–69.

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