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ABSTRACT**

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**Template synthesis of core-shell MoS<sub>2</sub> @N/C nanocage Multifunctional Electrocatalysts for DSSCs, ORR and OER**

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Due to its unique characteristics of large specific surface area of transition metal dihalides (TMDs) and clear hollow metal-organic framework (MOF), are widely used in dye sensitized solar cells (DSSCs), oxygen reduction (ORR), oxygen evolution reaction (OER) and other fields. 2D transition metal dichalcogenides (TMDs) analogous structure like graphite, its structure is composed of three atomic layers, a W layer sandwiched between two S layers, and the triple layers are stacked by weak van der Waals interaction.<sup>[1]</sup> Metal-organic framework (MOF) synthesized by the assembly of metal nodes and organic linkers, have emerged as promising materials for diverse applications due to their high porosity and ultrahigh surface area.<sup>[2]</sup> Calcinate the MOF material at high temperature, get the N-doped hollow carbon nanocages. TMDs combined with MOF templating synthesis of few-layered WS<sub>2</sub> Nanoplates confined in Metal-organic framework Nanocages for dye-sensitized solar cells as the counter electrode.<sup>[3]</sup>

N/C hollow metal-organic frame structural materials were prepared and used as templates to grow MoS<sub>2</sub> core-shell and encapsulated them in MOF with a W-N interfacial coupling center. During the pyrolysis process, after carbonization, ZIF-67 becomes Co, N-doped C material,

which effectively inhibits the growth of MoS<sub>2</sub> and forms the multi-functional group MoS<sub>2</sub>@N/C material. Among them, the MoS<sub>2</sub> core-shell structure has better catalytic performance than the layered structure, and the N/C hollow frame structure is conducive to electron transmission and electrolyte entry, so as to fully expose the active sites and improve the catalytic and conductive properties of the material through synergistic effects. It is prepared to be core-shell MoS<sub>2</sub> @N/C nanocage multifunctional electrocatalysts for DSSCs, ORR and OER.

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