Synthesis of Mo_2C/MoC/C composite for hydrogen evolution reaction

Presented by

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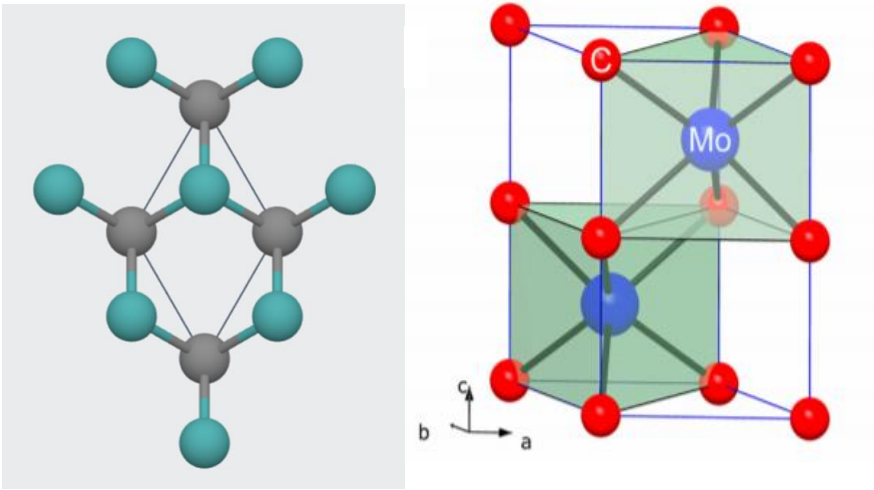
- **The increasing demand for energy caused by rapid economic development along with the environmental crisis has stimulated the pursuance of clean and sustainable fuels.**
- **Hydrogen (H_2) is a clean and renewable source of energy and can replace our traditional fossil fuels, which are limited.**
- **H_2 can be produced by electrocatalytic water (H_2O) splitting or hydrogen evolution reaction.**
- **It requires an efficient electrocatalyst with high stability and low cost.**
- **The conventional platinum (Pt) shows the highest catalytic activity towards HER, to date.**
- **Mo_2C has platinum-like electronic structures and hence shows high catalytic activity for electrochemical reactions, which greatly reduced expense.**

Mo_2C Structure and Properties

- **Molybdenum carbide possess two phase which are MoC and Mo_2C.**
- **Different crystalline phases of Mo_2C are *hexagonal α-Mo_2C* and *orthorhombic β-Mo_2C.***
- **Mo_2C contains three type of bonding: metallic bonding (rearrangement of metal-metal bonds); covalent bonding (bonding formation between metal and non-metal (carbon)); and the ionic bonding (charge transfer between metal and non-metal (carbon)).**



Mo_2C (Hexagonal)

Ref. Cryst. Growth. Vol. 517, pp. 24–27, 2019.

Synthesis procedure

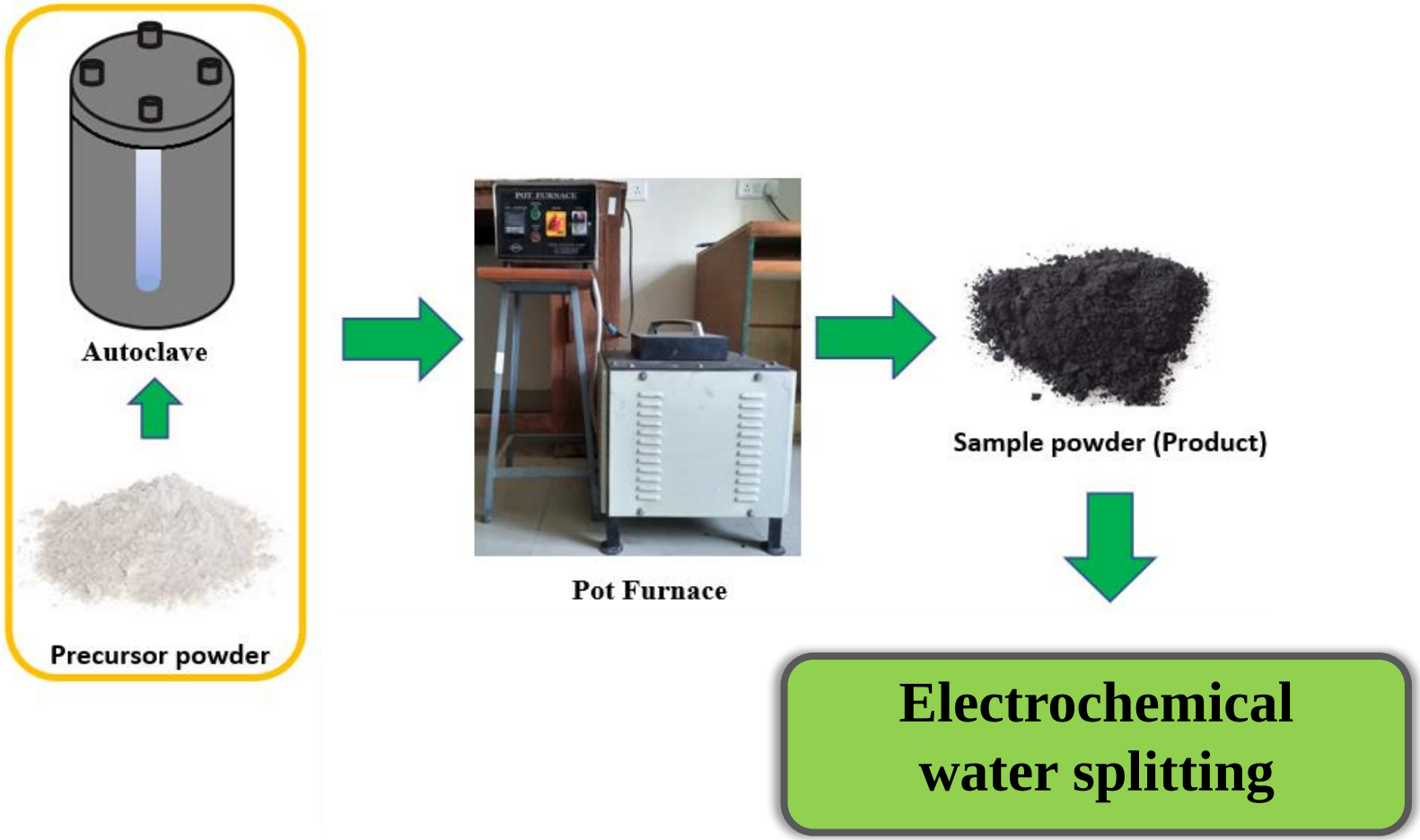


Figure 5: Schematic illustration for the synthesis of Mo_2C/MoC/C composite.

X-Ray Diffraction Analysis

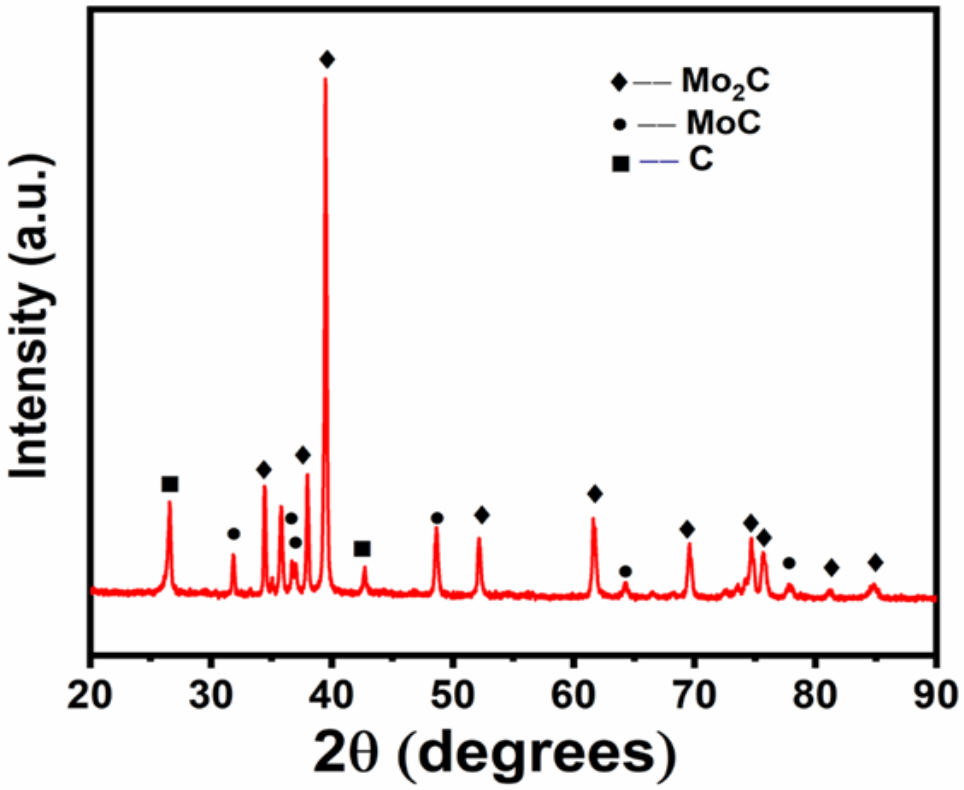


Figure 3: XRD pattern of Mo_2C/MoC/C powder synthesized at 800 ^oC for 12h (Mo:C=1:10)

Electrochemical Studies

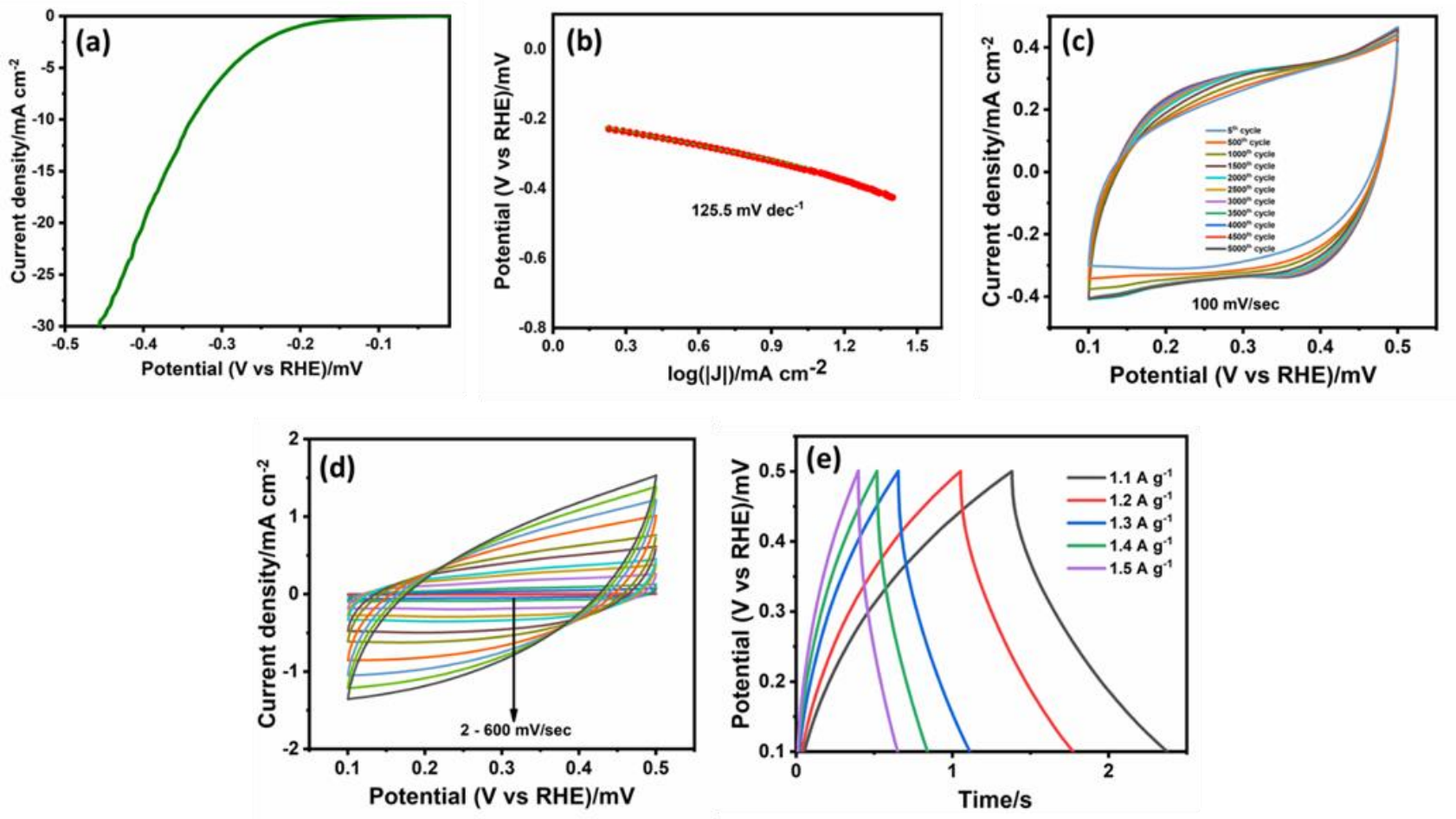


Figure 4: (a) LSV curve, (b) Tafel plot, (c) CV for 5000 cycles, (d) CV at various scan rates, (e) GCD curves of as-synthesized Mo_2C/MoC/C composite.

Conclusion

- **In this work, Mo_2C/MoC/C composite has been synthesized through high temperature carburization reduction route.**

- **The XRD analysis revealed the formation of Mo_2C, MoC and C phases within the sample.**

- **The prepared sample shows a Tafel slope of only 125.5 mV/dec and long term stability up to 5000 CV cycles.**

- **It shows a specific capacitance of 6.64 F/g at a current density of 1.1 A/g.**

Thanks