Hybrid nanostructured compounds of Mo_2C on vertical graphene nanoflakes for highly efficient hydrogen evolution reaction.

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Abstract

Organizing a post fossil fuel economy will require the prior development of sustainable energy carriers. Hydrogen is expected to play a significant role in this direction, being the most efficient one, thus nowadays it exists an emerging demand regarding its production. Green hydrogen produced by water splitting produces zero carbon emissions but requires the use of expensive catalysts. Therefore, the demand for efficient and economical catalysts is constantly growing, Transition metal carbides, and especially Mo2C, have attracted a lot of attention since they are earth-abundant and hold great promises for efficient performance towards the hydrogen evolution reaction [1]. The present study presents a bottom-up approach for the deposition of Mo carbides nanostructures on vertical graphene nanowalls templates [2], combining chemical vapour deposition, magnetron sputtering and thermal annealing processes. Results highlight the importance of adequate loading of graphene templates with the optimum amount of Mo carbides, controlled by both deposition and annealing time (Fig. 1), to enrich the available active sites. The resulting compounds present exceptional activities towards HER in acidic media, requiring overpotentials of 82 mV at -10 mA/cm2, and demonstrating a Tafel slope of 56 mV/dec (Fig. 2). The high double-layer capacitance and low charge transfer resistance are spotlighted as the main causes of the enhanced HER activity. These results are expected to pave the path toward the design of novel hybrid nanostructures based on nanocatalysts deposition on three-dimensional graphene templates.

References

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[2] **S. Chaitoglou (corresp. author),** R. Amade, E. Bertran *Insights into the inherent properties of vertical graphene flakes towards hydrogen evolution reaction.* **Applied Surface Science** 592 **(2022)** 153327 Authors, Journal, Issue (Year) page

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