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SYNTHESIS OF BOROPHENE NANOSTRUCTURES BY ULTRASONIC EXFOLIATION AS SUPPORT OF NOBLE METAL NANOPARTICLES FOR POTENTIAL H2 PRODUCTION

Borophene is a relatively new material nanosheet-like and is the lightest known 2D material. As boron is a neighbor of carbon it is expected to have similar properties to this material. Borophene synthesis remains an actual challenge due to the bulk bond configurations of boron. Theoretically, a triangular network could be more stable if it has periodic holes and it can grow on metallic surfaces such as Ag (111), Au (111), Cu (111) by chemical vapor deposition (CVD).

The present work aims to synthesize borophene nanosheets by the ultrasonic exfoliation method for the further decoration with noble metal nanoparticles to increase the photocatalytic activity of the nanosheets and enhance its activity in the hydrogen evolution reaction conducted by light absorption.

Borophene was synthesized following the reported method by Fu, Y. et al in which boron powder is added into 1-Methyl-2-pyrrolidinone (NMP). This mixture is then stirred and grinded, and then sonicated with a probe-type sonicator at 600 W, with a pulse on/off of 4 s for 4 h in an ice bath. The obtained solution was sonicated in an ice bath. Then it was centrifuged, and the supernatant was separated for another centrifugation to obtain the precipitate. The synthesized boron nanosheets were washed with distilled water, ethanol and acetone to remove the NMP.

TEM shows a few-layers nanosheets of borophene and SAED indicated good cistallinity. On the other hand, noble metals NPs were synthesized by wet chemical methods to have better control over the shape and size of the nanoparticles. UV-Vis spectroscopy demonstrates typical absorption bands due to longitudinal and transverse LSPR of the synthesized noble metal nanoparticles. SEM and TEM confirmed nanospheres shape.

Keywords

borophene, noble metals nanoparticles, hydrogen production

Reference

Y. Fu, et al Borophene-based mixed-dimensional van der waals heterojunctions for high-performance self-powered photodetector,Applied Surface Science, Volume 611, Part A, 2023,155668.

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