Robust Superhydrophobic Foam: A Graphdiyne-based Hierarchical Architecture for Oil/water Separation

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Abstract

Recently, exploitation and designment for functionalized materials with superhydrophobicity have stimulated many interests owing to its intriguing potential applications ranging from self-cleaning, antifogging, oil/water separation, and even energy-related field. Superhydrophobic performance of materials is strongly dependent on their specific micro/nano hierarchical structures. However, barely methods could generate ordered microstructures on robust foam substrates, placing great difficulties in predicting practical performance and thus designing high-efficient superhydrophobic materials.

In this work, graphdiyne (a novel carbon allotropes) with ordered vertical honeycomb-like nano-level structures was in-situ grown on the copper foam by Glaser-Hay coupling, creating micro-nano two-level microstructures. After PDMS vapor deposition, the as-prepared foam showed not only extraordinary superhydrophobicity both in the air (~160.1°) and in the oil (~171.0°), but also high resistivity towards abrasion cycles. Owing to its three-dimentional porous structures and numerous superhydrophobic surfaces with ordered microstructures, a robust superhydrophobic foam can be fabricated for both practical applications and theoretical analysis. As one example, the as-prepared foam was used for oil/water separation, exhibiting both high efficiency and good recyclability. Considering the intriguing physicochemical properties of graphdiyne, it may also shows promise in various potential applications.

References

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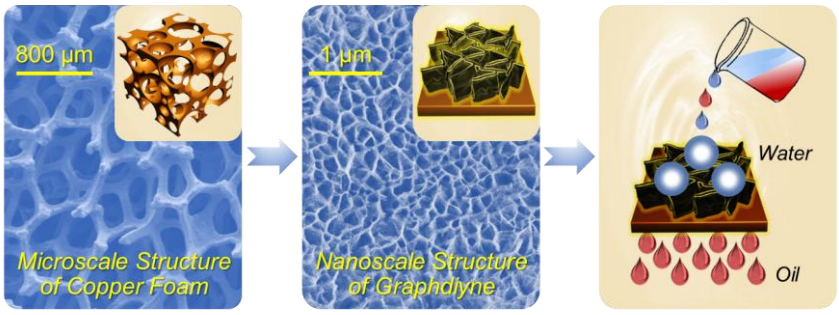
Figures



Robust Superhydrophobic Graphdiyne-based Foam