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Unlocking industrial applications via Graphene composites

Graphene as a next generation wonder material possess unique physical and chemical properties, such as a two dimensional, atomic-thick chemical structure, superior electric and thermal conductivities, flexible, light-weight yet strongest material known to date, feasibility to tuning the surface from hydrophilic-to-hydrophobic, etc. [1] Exploiting such properties to develop industrial applications is the key challenge in front of the scientific and industrial community. Processing graphene materials alone is not industrially viable, due to their poor dispersion and film formation abilities.[2] Graphene can be mixed with a variety of materials like polymers, additives and nanomaterials to form hybrid materials which could enhance the efficiency of existing technologies.[3] Understanding the effect of chemical composition, degree of oxidation, lateral size and interface morphology of graphene or its oxide forms in such hybrid composites is crucial to developing important industrial applications like water filtration membranes, separator in Li-ion batteries, sensors, gas separation and high temperature plastics, etc.

In addition, developing simple, aqueous-based, low-temperature product fabrication methods is preferable for commercialization processes. In this work, we present aqueous-processable, room temperature casting/coating methods to achieve a series of graphene composite products for key applications like desalination, waste-water treatment, ion-selective membranes for battery separators, wearable sensors etc. In the process, we have studied the effects of graphene composition, oxidation degree on the performance of its filtration and sensor devices.

References

[1] Kian Ping Loh, Qiaoliang Bao, Priscilla Kailian Ang, Jiaxiang Yang, J. Mater. Chem., 20 (2010) 2277-2289.
[2] David W. Johnson, Ben P. Dobson, Karl S. Coleman, Curr Opin Colloid Interface Sci., 5-6 (2015) 367-382.
[3] Xiao Huang, Xiaoying Qi, Freddy Boey, Hua Zhang, Chem. Soc. Rev., 41 (2012), 666-686.

Figures

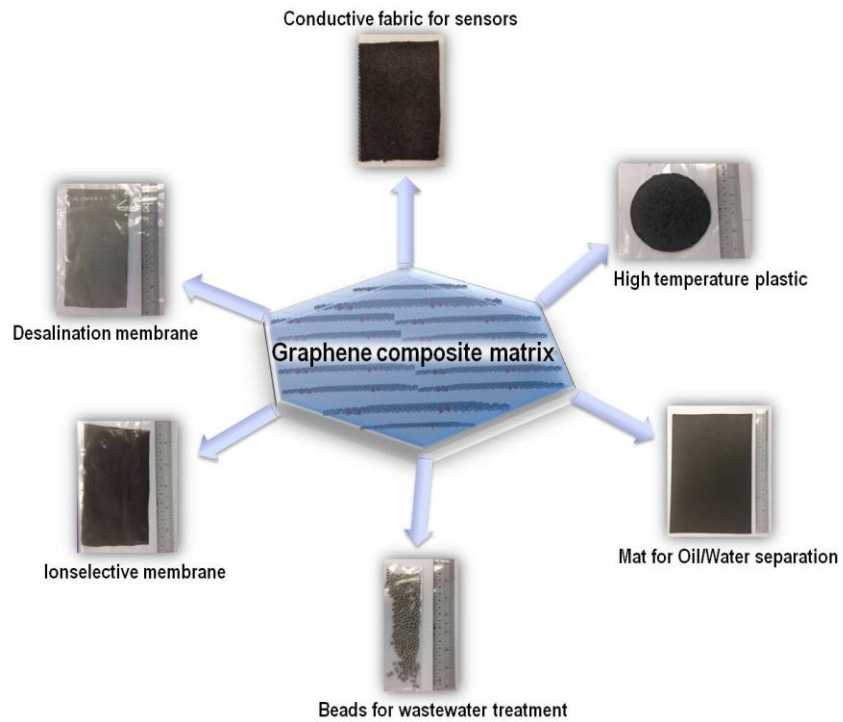**Figure 1:** Schematic depicting of the graphene composite matrix and the yielded products for different industrial applications.