

# Magnetic Alignment of Graphene & Graphite Flakes and their Device Applications

## Summary

A novel method for aligning graphene flakes in macroscopic order using magnetic fields. Aligning nanomaterials, like graphene flakes, optimizes the optical, electrical, and mechanical properties of the material. For this method, graphene flakes are suspended in a solution that is subjected to a magnetic field induced by commercially available magnets. The alignment of the graphene flakes within the solution is controlled by this magnetic field. Additionally, the changes in orientation of the graphene flakes caused by the magnetic field can be observed by a darkening in color within the solution where the magnetic field has been applied. A magnetic field can be detected and its characteristics can be observed by the changes in color of the graphene flakes in suspension. Therefore, this technology is beneficial for magnetic field sensor technology. The color changing qualities of the graphene suspension can also be utilized for magnetically controlled display technology.

## Competitive Advantages

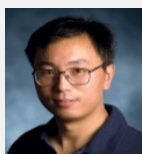
- Capable of aligning graphene flakes without using mechanical stress, which is not suitable for most device applications
- Ability to arrange graphene flakes with magnetic fields from commercially available magnets, rather than much larger magnetic fields used on other diamagnetic nanomaterials
- Promising ability to show the characteristics of magnetic fields
- Cost-effective method for aligning graphene flakes

## Meet the Inventor

### Dr. Jiming Bao

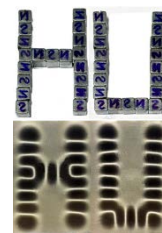
Associate Professor

DEPARTMENT of ELECTRICAL ENGINEERING



### Research Interests:

- Semiconductor nanowire optoelectronics
- Silicon Photonics
- Solar water splitting
- Fiber Optic Sensors



## Problem Addressed

- Identifying a more flexible method for aligning 1D and 2D nanomaterials to create functional macroscopic objects with optimal optical, electrical, and mechanical properties
- Magnetically orienting graphene flakes, which has never been accomplished previously

## Applications

- Magnetic field sensors
- Magnetically controlled displays
- Scientific instrumentation
- Education tools

## Patents

- US 2017/052238

## Publications

- Bao, J. et al. (2017) Orientation Control of Graphene Flakes by Magnetic Field: Broad Device Applications of Macroscopically Aligned Graphene. *Advanced Materials*, 29(1)

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