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Sustainable large-scale production of graphene materials for electromagnetic interference shielding

NANOTECHNOLOGIES
Siva Sankar, João Rodrigues, Pedro Alpuim, Andrea Capasso

BACKGROUND

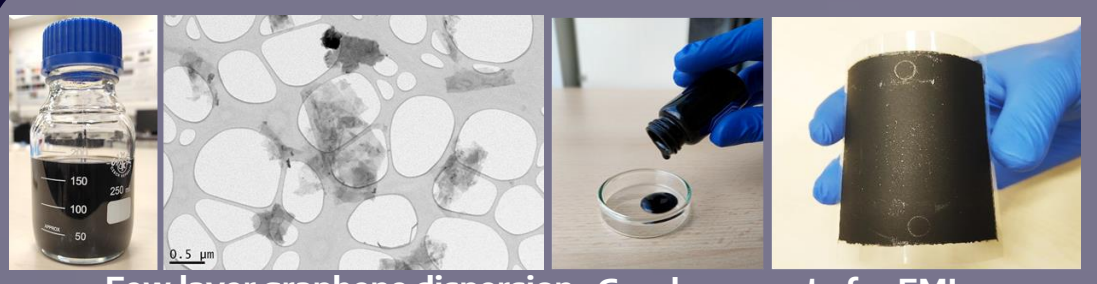
Unwanted electromagnetic interference (EMI) is generated by any electromagnetic field, be it natural or human-made, capable of causing malfunction or damage in electrical and electronic devices, including those crucial in defense and space technology. Materials with high conductivity, such as metals, are typically used to fabricate EMI shielding coatings. However, metals present issues related to their weight, cost, and chemical stability. In this context, graphene-based materials offer a potential solution by providing at once high electrical conductivity, lightweight, flexibility, stability, and cost-effectiveness. Liquid phase exfoliation (LPE) techniques have the potential for a large-scale and inexpensive production of graphene-based materials for EMI shielding applications.

GRAPHENE PRODUCTION – A NEW STRATEGY

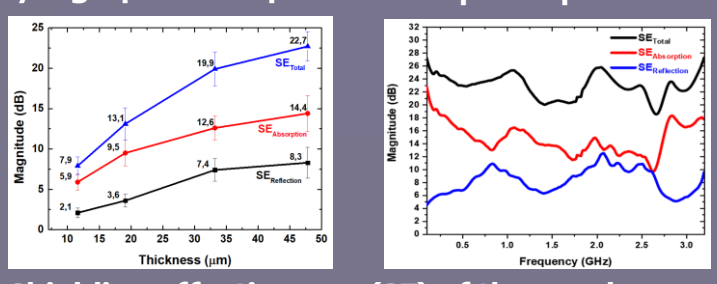
We propose a novel LPE process (combination of high-shear mixing and high-pressure airless spray) for large-scale, low-cost manufacture to turn natural graphite powder into few-layer graphene nanosheets in water. In this way, highly stable graphene dispersions (~ 6 months) with high throughput (1 L/h) & yield (2 g/L) were produced. We adjusted and optimized the formulation of the obtained dispersions with natural binders, thus creating an all-carbon, highly conductive and viscous paste that offers a strong adhesion to any flexible substrate. We fabricated coatings of different thickness on polyethylene terephthalate (PET) and tested their EMI shielding effectiveness. In the future, these robust and lightweight coatings will be applied to shield electronic components from undesired interference.

RESULTS

- Stable graphene dispersions in water were achieved.
- The nanosheets are atomic thick with lateral size ~ 1.7 µm.
- Graphene conducting pastes deposited on PET exhibit strong adhesion
- Coatings with 50 µm thickness achieved a shielding effectiveness (SE) of 25 dB.



Few layer graphene dispersion **Graphene paste for EMI**



Shielding effectiveness (SE) of the graphene coatings

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