

# International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

Balapur P.O., Hyderabad – 500005, Telangana, India



## Scalable production of ultrathin graphene nanoplatelets

### Overview

2-D graphene nanosheets, which is composed of one atom thick  $sp^2$  carbon network, shows great potential for industrial applications owing to their excellent electrical, thermal mechanical, electronic, chemical properties and high surface area. Preparation of graphene through exfoliation and fragmentation is one of the most effective methods to produce graphene-based conductive materials in a large quantity. The exfoliation through microwave irradiation is much more cost-effective than all other methods as it heats the materials uniformly and effectively. The graphite structures consist of layers of hexagonal carbon structures within which a chemical compound can be intercalated and is escaped due to thermal shock by creating large number of pores in worm-like structured exfoliated graphite. This unique process exhibited volume expansion of 300 % with extremely porous structure. Graphene nanoplatelets (GNP) shown specific surface area of  $117 \text{ m}^2/\text{g}$ . As produced GNP are highly crystalline in nature with very limited defects. GNP preparation by microwave irradiation and shear mixing is a unique novel process for bulk production.

### Key Features

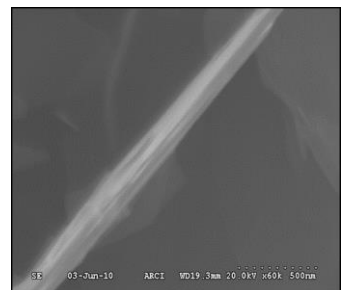
- Very high aspect (width to thickness) ratio
- Majority of platelets are less than 10 nm thickness
- Compatible with almost all polymers
- Thermally and electrically conductive
- Contains naturally occurring functional groups like carboxyl and hydroxyl
- Scalable production process



Digital photograph of ultrathin graphene nanoplatelets (in bulk quantity)

### Potential Applications

- Electrode for Supercapacitor
- Thermally conductive additive
- Electrically conductive additive
- Wear and friction modifier
- Additive for composite materials (polymer, metal and ceramic matrix)
- Anode material for metal-ion batteries (Li, Na and K)



SEM micrograph of ultrathin graphene nanoplatelets

### Intellectual Property Development Indices (IPDI)

- Scalable quantity with tailored sizes
- Scale-up and prototype module has been established
- Demonstration of heavy-duty mixer-driven bulk production is underway

Status	1	2	3	4	5	6	7	8	9	10
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### Centre for Carbon Materials (CCM)

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