Potential application of iron nanoparticles encapsulated in graphene (INPEG)

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Carbon-covered iron nanoparticles (CCINPs) containing 3-8 nm iron nanoparticles encapsulated in graphene (INPEG) and 40-80 nm iron nanoparticles covered with defective carbon layers can be produced by facile one-stage plasma synthesis. Both CCINPs and INPEG demonstrate superperamagnetic properties Material can be dispersed and to some extent stabilized in oil and alcohol media, which opens an avenue for a series of potential applications.

1. **Magnetic and electroconductive inks.**
As iron nanoparticles are protected from oxidation at ambient temperatures by graphene layers, CCINPs can be used as much cheaper substitute of silver in conductive inks for various applications.

2. **Metallization of carbon surfaces**.
CCINPs can combine affinity to hydrophobic surfaces like carbon fibers with acceptable conductivity.

3. **Additives to plastics.**
Low weight combined with moderate conductivity can make CCINPs-filled plastics a good competitor to metals in electric devices.

4. **Additive to lubricants.**
CCINPs can provide all rolling friction preferences of fullerene with much lower price and higher mechanical stability.

5. **Catalysts support.**
Defective graphenic surface of CCINPs provide a number of sites for grafting of catalytically active groups. Moreover, the course of reaction might be affected by magnetic field via iron core.

6. **Magnetic transport.**
CCINPs can be used as "trolleys" to carry drugs to the tumours using external magnetic field.