COMPILED AND EDITED BY THE **CONNECT TEAM** BASED ON INPUT FROM THE FEATURED **RESEARCHERS**

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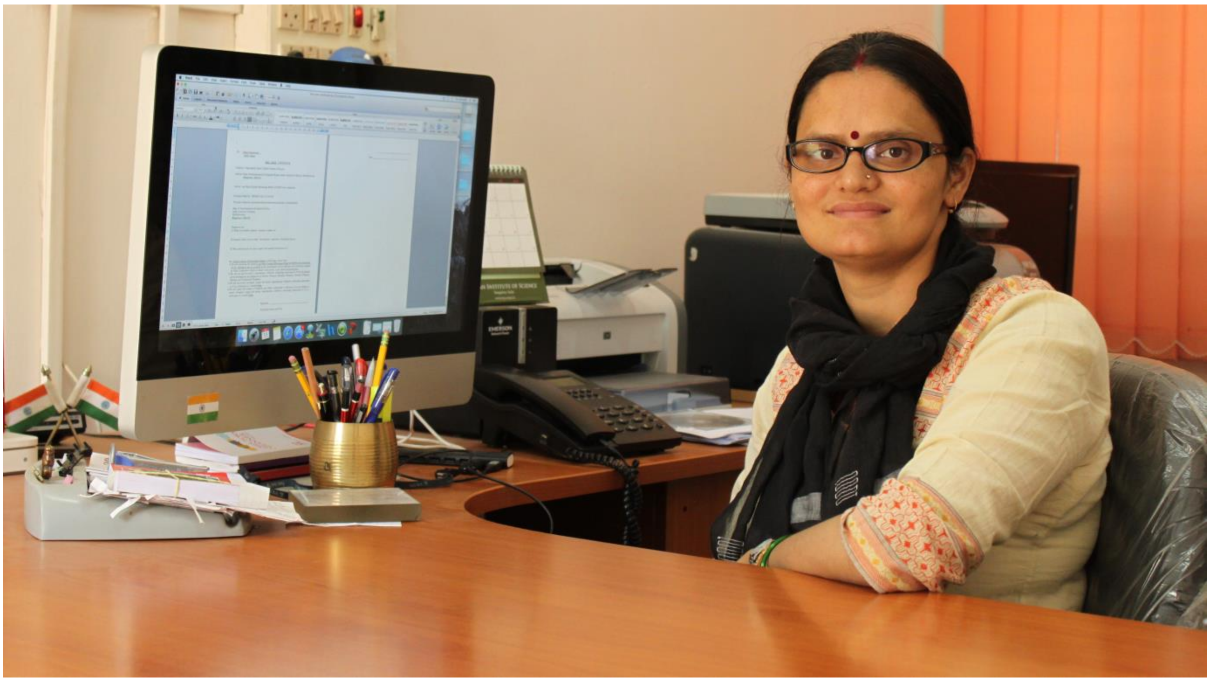

(ANWESHA MUKHERJEE)

Rearranging carbon atoms for a better world

Heading a very productive research group, many recognitions have already come Abha Misra's way—she is a recipient of the Indian National Science Academy Medal for Young Scientists and an Associate of the Indian Academy of Sciences and the National Academy of Sciences, India. Her research revolves around carbon, especially two of its more distinct, but related forms—graphene and carbon nanotubes.

In graphene, carbon atoms are present at the vertices of a hexagon—not unlike a honeycomb—and arranged in sheets, merely one atom thick. This structure bestows upon it extraordinary electrical, thermal, mechanical and optical properties. Graphene is also an ideal sensing material because of its high surface area. By combining a compound of graphene with hydrogen and tuning its energy band gap, Misra's lab has designed a device that detects infrared light with high sensitivity.

Misra's team has also found a way to enhance the generation of photocurrent—current produced when light is incident upon it—in a form of few layer graphene (FLG) by combining it with semiconducting nanowires in an arrangement that harvests energy more efficiently.

Another interesting property of FLG is that it responds differently to a flame along two different directions. This has allowed Misra's team to design a graphene-based flame sensor with a smart flame detection algorithm.

Carbon nanotubes (CNTs), by contrast, are long, hollow structures with graphene walls. CNTs can be used to detect gases such as ammonia, sulphur-dioxide, and hydrogen sulphide even in very low concentrations through unique charge-exchange phenomena. Misra's group has exploited this property to develop a prototype of a gas-sensing alarm system applicable in gas and oil industries as well in detecting LPG leakage.

A unique surface interaction between CNT in bundles leads to novel applications such as impact-absorbing macroscopic foam, bulk actuators, and sensing devices–chemical, photo and mechanical devices. Misra and her team have also shown that the strength of a fluid-filled CNT foam can be tuned using a magnetic field which could then be used for making artificial joints and shock absorbers by mimicking the biological systems.

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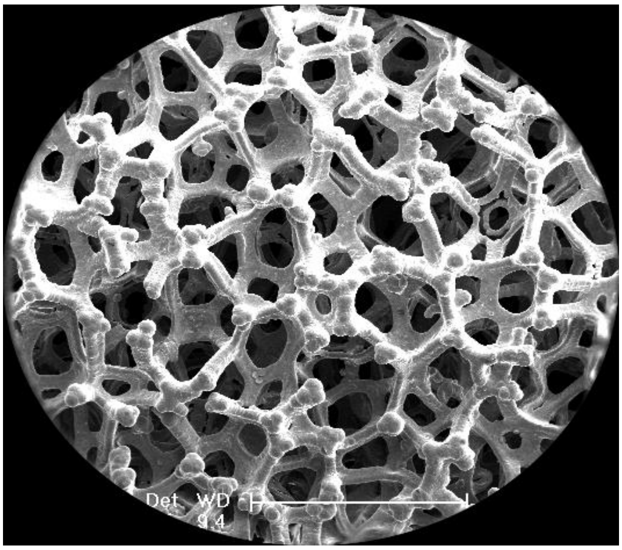

Graphene foam for impact absorption (Courtesy: ABHA MISRA)

Misra with her team (KG HARIDASAN)