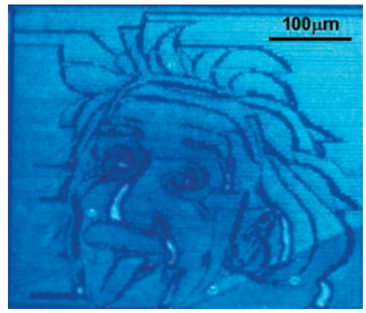
String of Lights: Quantum Dots Decorate Nanotubes

The use of carbon nanotubes (CNTs) in a variety of electronic and optical applications could be greatly enhanced by developing hybrid systems that combine CNTs with other nanomaterials, including quantum dots (QDs). Some groups have had success with developing methods that combine these two materials, ranging from chemical reactions to attach QDs onto both ends of CNTs to using a molecular linker to secure semiconducting QDs onto nanotubes. For these hybrid materials to be useful in device applications, it will be necessary to develop a strategy for assembling them reproducibly and controllably onto substrates.

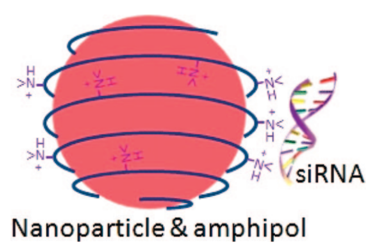
Extending these experiments, Lim *et al.* (p 1389) sought a way to attach QDs to CNTs micropatterned onto a surface reliably and selectively, a step toward creating components for optical or electronic devices. The researchers developed two different methods toward this end; both involved applying a suspension containing QDs of various sizes to an aligned array of intertwined multiwalled nanotubes, leaving the nanotubes "decorated" with the dots when the solution evaporated. The methods differ in whether the researchers used a technique known as laser pruning to pattern the nanotubes before applying the solution or after it had dried, the latter of which avoids problems with pattern distortion during evaporation. Using the latter method, the researchers created complex QD-decorated patterns. Further experiments showed that the branching surface of the nanotubes acts as a sieve, sorting the QDs as they sink into the intertwined nanotubes according to size. The results suggest a new and viable controlled assembly for hybrid CNT-QD materials.



Passing Interference? Nanocomplex Delivers, Tracks siRNA in Cells

RNA interference (RNAi), a technique that suppresses gene activity in a sequence-specific manner, continues to grow in popularity for use in almost every biological field. Applications for this technology range from functional gene analysis to therapeutics. Passing the small interfering RNAs (siRNAs) necessary to exert RNAi's effects into cells is possible using viral and other delivery methods. However, to prevent immunogenic and oncologic effects, some researchers are interested in developing alternative methods to deliver siRNA to cells. A bonus of any new delivery vehicle would be a way to track siRNA after it enters cells to ensure its transport and release, a trait that current methods do not possess.

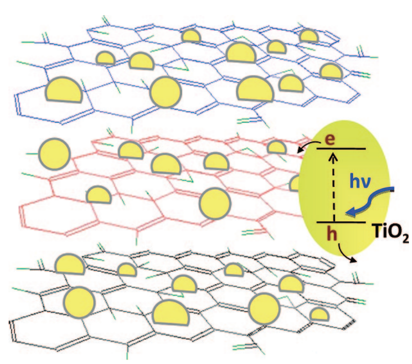
Toward that end, Qi and Gao (p 1403) developed a nanocomplex that has greater efficacy than some other currently used delivery agents while also allowing real-time imaging of siRNA transport and release. The researchers fabricated this new delivery agent from semiconductor quantum dots (QDs) and amphipols, which form a stable complex when combined. Upon testing this new combined material bound to siRNA, the researchers found that it had greater efficacy in delivering siRNA and silencing a gene of interest in human breast cancer cells than Lipofectamine or polyethyleneimine, two common siRNA carriers. Additionally, because of the intrinsic optical properties of the nanocomplex QDs, the researchers could use confocal microscopy to monitor the entry of siRNA into cells, endosome escape, and transport in real time. Additional experiments showed that the complex has low cellular toxicity. Together, these characteristics could make QD-amphipol complexes a valuable future addition to RNAi studies.



Graphene Oxide Reduced, Potential Boosted

The single-atom thick sheets of carbon known as graphene have interesting electronic, optical, and mechanical properties that could make them useful in a variety of applications. A common preparation of graphene is mechanical exfoliation into individual sheets so that it remains in a reduced form, a state that can be difficult to achieve and to maintain.

In a new study, Williams *et al.* (p 1487) sought a solution to this problem through photocatalysis, and reduced graphene oxide (GO) with electrons from TiO_2 by irradiating the materials together in solution with UV light. During irradiation, the researchers found that the solution changed color over several minutes from light brown to black, a sign that the reduction had taken place by transferring electrons from TiO_2 to the graphene. Further experiments showed that the reduced graphene interacted and coupled with the TiO_2 particles to create a nanocomposite. Observations with atomic force microscopy suggest that the graphene in this nanocomposite is maintained as individual or bilayer sheets, with the direct interaction between the graphene and TiO_2 particles preventing the exfoliated sheets of graphene from collapsing. To test the resistance of the photocatalyzed nanocomposite, the researchers spread suspensions of GO-TiO_2, either irradiated or not, on gaps in gold-sputtered borosilicate glass slides. Tests showed an overall decrease in resistance following UV exposure. The researchers suggest that this photocatalytic methodology, used either with TiO_2 or possibly other semiconductor particles, could offer a new way to reduce GO and preserve it in individual semiconductor-composite sheets on demand.



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