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CdTe nanoparticles self-organize in solution

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Researchers from the University of Michigan, US, have made sheets of cadmium telluride nanoparticles assemble in solution for the first time. The team says that the nanocrystals behaved in a similar way to the surface layer (S-layer) proteins that make up the cell membranes of certain bacteria.

"This [work] establishes an important connection between two basic building blocks in biology and nanotechnology – proteins and nanoparticles – and this is very exciting for assembling materials from the bottom up for a whole slew of applications ranging from drug delivery to energy," Nicholas Kotov told *nanotechweb.org*. "The combination of experiment and modelling enabled the clear demonstration that the formation of the 2D sheets of the nanoparticles is qualitatively similar to that of S-proteins. The latter can form sheets with both hexagonal and cubic packings due to highly anisotropic interactions between them."

Kotov and colleagues used 2-(Dimethylamino)ethanethiol (DMAET)-stabilized CdTe nanoparticles with positive charges. In solution, the nanoparticles self-assembled into 2D free-floating sheets about 2 μm wide and roughly 3.4 nm thick. The nanoparticles retained their luminescent properties. Sharon Glotzer and her team then analysed the process using computer models.

"The team demonstrated that the forces between the nanoparticles, which were previously treated as pretty much isotropic spheres, can be strongly anisotropic, and consist of the same components, such as ionic, dipole-dipole and hydrophobic interactions as those among globular proteins," said Kotov.

The researchers reckon their findings could help in applications such as self-organized structures for energy harvesting reminiscent of bacterial photosynthetic centres. "Also the similarity of forces between nanoparticles and proteins can lead to new biomedical technologies capitalizing on their self-organization behaviour and potential specificity of assembly processes," said Kotov.

Now the team plans to find new systems of nanoparticles with similar properties and to "expand understanding of the similarity of interactions by potentially including hydrogen bonding forces in the self-organized structures".

The researchers reported their work in *Science*.

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