Smart thin film membranes adopt properties of guest molecules

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Virginia Tech researchers announced last year that they had created a nanostructured membrane that incorporates DNA base pairs in order to impart molecular recognition and binding ability to the synthetic material. This year they will show for the first time that these new films, membranes, and elastomers are compatible with diverse organic and inorganic molecules and will adopt properties of the guest molecules.

The research is being presented as an invited talk at the 233rd national meeting of the American Chemical Society in Chicago March 25-29.

Chemistry professor Tim Long's research group, students affiliated with the Macromolecule and Interfaces Institute (MII) at Virginia Tech, and the U.S. Army Research Laboratory created a block copolymer, where different monomers are linked in a sequential manner and form a nanostructured film. They used adenine and thymine nucleotides, two of the four DNA base pairs that recognize each other. Then the researchers experimented with different kinds of guest molecules with complementary hydrogen bonding sites (hydrogen has a low energy attraction to many types of atoms).

The low energy attraction, means the guest molecules are widely dispersed throughout the membrane, which then takes on the properties of the guest molecules. "For example," said Long, "if the guest molecules have ionic sites (sites with positive and negative charges), you will be able to transfer water through a film because you would have ion channels at the nanoscale. It's similar to the way a cell membrane works

to control the flow of specific ions into a cell. You can create protective clothing – against chemicals – that would still allow water vapor through."

Salts, as ordinary table salt, are hydrophilic (water loving) and their introduction into a block copolymer template permits the placement of the salts at the nanometer dimension. One can imagine forming of channels of salts that are not visible with the human eye, but act as a roadway for the transport of water molecules.

"The research is synergy at the nanotechnology-biotechnology interface," Long said.

The talk, "Nucleobase-containing triblock copolymers as templates for the dispersion of guest molecules at the nanoscale" (PMSE 423) will be presented today in McCormick Place South room S505A. Authors are Brian Mather of Albuquerque, a chemical engineering doctoral student in MII; Margaux B. Baker, an undergraduate student from the University of Michigan who studied with Long's group during summer 2006; Long, and Frederick L. Beyer of the U.S. Army Research Laboratory.

Source: Virginia Tech