Chemists create new polymers by adding DNA base pairs

September 12 2006

Chemists at Virginia Tech are creating new polymers by adding DNA base pairs. Attributes include improved stretchable behavior and self-healing polymer films and coatings.

The research will be presented at the 232nd national meeting of the American Chemical Society in San Francisco September 10-14, 2006.

Base pairs are the nucleotides on each side of the rungs that connect the strands of the DNA ladder. Adenine pairs with thymine; cytosine pairs with guanine.

Brian Mather of Albuquerque, a chemical engineering graduate student who is working with chemistry Professor Timothy E. Long in the College of Science at Virginia Tech, is studying how these molecules recognize each other in supramolecular complexes. He is attaching adenine and thymine as the outer sequences of triblock copolymers. These are polymers where the units of a molecular chain are connected in blocks of the same structure (xxxxxxxyyyyyyyyzzzzzzzz) rather than mixed randomly. "The base pair-containing block copolymers are used as precursors for subsequent molecular recognition," said Long.

"We are trying to integrate molecular biology with traditional macromolecular science in order to synthesize novel families of elastomers. The base pairs disassociate when heated and permit the polymer to easily flow in the melt state, making it easier to process with less energy," said Long. "When the triblock copolymer cools, the pairs

reconnect and provide desirable elasticity and molecular recognition possibilities."

He said, "The concentration of base pairs can be very low because they are exquisite at recognizing each other. The strength of recognition is high and tunable."

The heated material is poured in a mold or applied to a surface to become a thin film. "We believe we can create thermo-reversible or self-healing surfaces, such as a windshield that will smooth if a small crack is generated," said Long.

The technology is one that is being investigated by the Multilayered Technologies for Armored Structures and Composites (MultiTASC) Materials Center of Excellence at Virginia Tech with funding from the Army Research Laboratory.

"This research could also benefit Southwest Virginia," Long said. "It could be the basis of biomaterial technologies developed by the Virginia-Maryland Regional College of Veterinary Medicine or the Virginia College of Osteopathic Medicine here and that a local company might produce. The Macromolecular Interfaces with Life Sciences (MILES) National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) program at Virginia Tech facilitates these types of discoveries."

Source: Virginia Tech