Molecular breakthrough for plastic electronics

The potential applications for flexible plastic electronics are enormous -- from electronic books to radio frequency identification (RFID) tags to electronics for cell phones, personal digital assistants (PDAs) and laptop computers -- but certain technological hurdles must be overcome before we see such widespread use. Now a Northwestern University team of materials chemists report a breakthrough in the race to find the right materials for producing cost-effective, high-performance plastic electronics. The findings appear in the Proceedings of the National Academy of Sciences (PNAS).

The team, led by Tobin J. Marks, Vladimir N. Ipatieff Professor of Chemistry and professor of materials science and engineering, has designed organic molecules that self assemble into an ultra-thin layer (less than six nanometers thick) for use in the dielectric, or nonconducting, component of a transistor. Their tailored molecular components reduce both operating voltage and power consumption in organic thin-film transistor (OTFT) structures, making low-power consumption OTFTs a reality. "This means having plastic electronics the size of a pen battery -- rather than an automobile battery -- power your cell phone," said Marks. "And, instead of being carved out of silicon, transistor structures would be printed in a fashion similar to that of newspapers, but with organic molecules as the ink and plastic as the paper. Much as the New York Times prints a different edition of the newspaper every day, we could flexibly print a wide variety of electronic devices quickly, easily and cheaply." Examples include RFID tags for labeling items in a store or tracking them in a factory. "You could walk up to a cash register at the grocery store," said Marks, "and it would automatically sense what each item costs and whether or not it has passed its expiration date -- all in one step." In their paper, Marks and fellow authors Antonio Facchetti, research professor of chemistry, and Myung-Han Yoon, a graduate student in chemistry, showed that their new nanodielectric multilayers have very high capacitances (the ability to store an electrical charge) and excellent insulating properties and are compatible with a variety of organic semiconductors and substrate materials, the other key components of a transistor. Source: Northwestern University