Nanowires: Next Big Small Thing

Pierre Deymier is growing cell-division proteins to build biological microchips.

Professor Pierre Deymier

Pierre Deymier, professor of materials science and engineering and director of the UA's School of Sustainable Engineered Systems, and his team have patented a bioengineering process that could completely transform microchip manufacture.

Through a combination of biological processes and electroless copper deposition, the research team has created tiny wires based on proteins called microtubes. The key component of this patent is the ability to deposit copper inside the nonconducting microtubules to make tiny insulated wires.

"The key is to metalize the inside of the microtubes before the outside," Deymier said. Histidine, which has a strong affinity for copper, forms naturally inside the tubules, and the metallization process starts there. By properly timing the copper salt cycle, copper forms only inside the microtubules, resulting in tiny insulated wires.

One of the key breakthroughs was finding a biologically benign deposition process that wouldn't harm microtubule function or structure. This process was developed by professor Srini Rahavan and his students in the department of materials science and engineering.

In addition to their use in connecting molecule-size circuit elements, microtubule-based Nanowires might be used to extract current from solar cells that mimic photosynthesis, Deymier said. These plant-like photo cells include light-sensitive plant proteins that capture photons and produce electrons. Nanowires could be used to channel these electrons to the outside world.