In solution, tiny magnetic wires scatter light

March 14 2005

Maneuvering external magnets, scientists can command the direction in which light bounces off tiny, magnetic wires that sway like matchsticks in thick, slow-moving solutions.
Announcing her finding at the 229th meeting of the American Chemical Society, University of Wisconsin-Madison materials chemist Anne Bentley described how suspended nickel wires - each 200 times thinner than a human hair - could one day serve as magneto-optical switches. The switches could aid in fields such as photonics, where light, rather than electricity, relays information.

"In a broader sense, it is also helpful to study how these wires behave in wet situations because if they are ever medically used, there is little inside our bodies that's dry," says Bentley, who suspended her wires in several types of fluids and found that the light-directing phenomenon was most consistent when she used "molasses-like" liquids such as glycerol.

"Another advantage that 'magnetic fluids' may have over other light-directing devices, such as mirrors, is that fluids can easily take various shapes," Bentley adds.

Bentley calls her microscopic wires "nanowires" after nanotechnology, the booming, cutting-edge science of small. The "nano" in nanotechnology derives from the nanometer, which is equivalent to a billionth of one meter. Several types of nanoparticles are already in use, in products such as sunscreens and inkjet printer ink.

But in the fledgling realm of nanowire research, Bentley is one of only a few scientists worldwide who is studying the properties of nickel nanowires. Other nano-scale structures under investigation include, for instance, non-magnetic carbon nanotubes.

Nanowires have not yet ventured outside the research arena, but researchers believe they will one day become critical components in ever-shrinking electronic circuits. Nickel nanowires, for instance, could play a key role in storing information, says Bentley. In particular, scientists could use external magnets to dictate the orientation and position of magnetic nickel nanowires within complex and tiny electronic systems. Without such control, says Bentley, working with nano-scale circuit parts could be like "trying to put Legos together with oven mitts on."

Source: University of Wisconsin-Madison