# Researchers build sharpest tip

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Forget the phrase, "sharp as a tack." Now, thanks to new University of Alberta research the popular expression might become, "sharp as a single atom tip formed by chemically assisted spatially controlled field evaporation." Maybe it doesn't roll off the tongue as easily, but considering the researchers have created the sharpest object ever made, it would be accurate.

The scientists, working out of the National Institute of Nanotechnology at the U of A, used a unique process to make the sharpest tip ever known and opened the door to a range of possibilities. Technically speaking, they were able to coat peripheral atoms near the peak with nitrogen, making it a one atom-thick, tough protective paint job.

"That coating has the effect of binding the little pyramid of metal atoms or Tungsten, in place," said Dr. Robert Wolkow, a physics professor at the U of A and co-author on the research paper published in the *Journal of Chemical Physics*. "Such a pointy pyramid of metal atoms would normally just smudge away spontaneously. It's like a sand pile--you know you can't make it arbitrarily pointy. If you try to pile on more sand, it flows down and makes a more blunt pile. Metal atoms will do the same thing."

These sharp tips are needed for making contact with metals or semiconductors as well as for the manipulation and examination of atoms, molecules and small particles. Ultrafine tips are demanded for future experiments where the results are directly dependent on shape of the tip.

The tips made by Wolkow and the research team--made up of Moh'd Rezeq and Jason Pitters from NINT--are so stable they withstand about 900 degrees Celsius. They are so sharp they appear so far to serve as excellent emitters of electron beams. "The lenses in an electron microscope work more perfectly if the electron beam comes from a really small point," said Wolkow. "Since we have the smallest point source of electrons, we think we will be able to make the best electron microscopes. This is speculation, but based on pretty conventional thinking.

"If this works, and it remains to be proven, it would be like taking a modest car and making it go like a race car by just changing its spark plugs. We would take a conventional electron microscope, put in one of our tips as the electron source and render the microscope instantly improved and capable of finer resolution."

Electron microscopes enable advances in diverse areas. Research problems that are just out of reach today but that could be made accessible by advances in electron microscopy include studies of the little pores that form in our cells walls and which are centrally important in the regulation of all life processes as well as new nano-structured materials that are ultra-light yet strong, allowing reduced energy consumption in vehicles.

Wolkow also expects their sharp tips will allow electrical characterization of extremely small objects, in turn allowing new device concepts to be discovered and tested.

Source: University of Alberta

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