Researchers find easy way to deposit metal nanoparticles on a surface using tape

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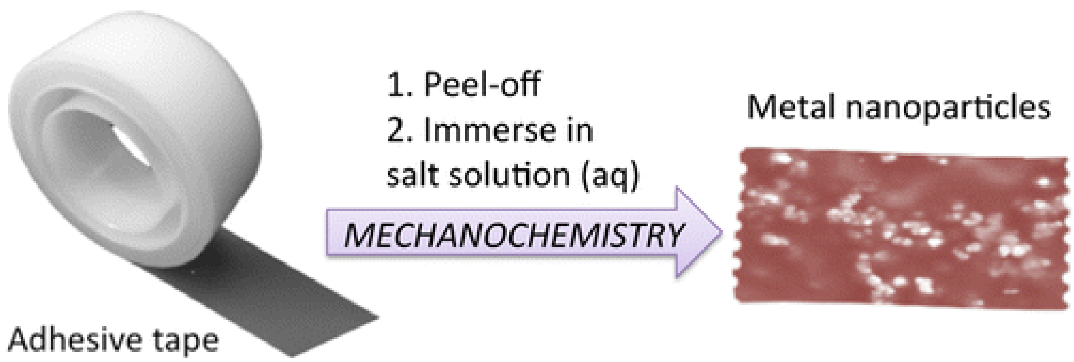

(Phys.org)—A combined team of researchers from Northwestern University in the U.S. and Bilkent University in Turkey has found that ordinary Scotch tape can be used to create a metal nanoparticle surface. In their paper published in the *Journal of the American Chemical Society*, the team describes how they used ordinary sticky tape to create the surfaces and why it worked so well.

Adding metal nanoparticles to a surface offers a way to confer properties onto it that would not be present otherwise—allowing rubbers to conduct electricity, for example. But, getting metal nanoparticles to adhere to desired products oftentimes involves a lot of time, effort or money (not to mention hazardous waste byproducts) which can detract from its usefulness. In this new effort, the researchers found that common, inexpensive sticky tape provides an opportunity for adding nanoparticles to a surface in a simple, clean way.

The researchers note that unspooling sticky tape from its roll causes bonds within the tape polymer to break which results in radicals forming on its surface—radicals that are attracted to metal nanoparticles. That meant, all they had to do was create a liquid solution with nanoparticles in it, drop a length of sticky tape into it and let it soak for awhile. The nanoparticles bonded with the radicals causing them to adhere, forming a layer on the tape material made of the nanoparticles, and that imbued the sticky tape with the attractive properties of the metal nanoparticles.

Using this method, the team created sticky tape strips with gold nanoparticles to increase electrical conductivity, copper to allow it to be used as a fungicide and silver to allow for use as an antibiotic. They noted that their process did not cause a reduction in stickiness, which meant the tape could still be applied to another surface, adding to its desirable attributes. Also they noted that the technique could be adapted to tapes not on a roll by using physical pressure to release the radicals. As one example, they placed a length of sticky tape into a bath of silver nitrate for a few hours—it turned yellow-orange, indicating that the silver in the bath had indeed formed a layer on the tape.

More information: Mechanochemical Activation and Patterning of an Adhesive Surface toward Nanoparticle Deposition, *J. Am. Chem. Soc.*, 2015, 137 (5), pp 1726–1729. DOI: 10.1021/ja507983x

Abstract
Mechanical pulling of adhesive tape creates radicals on the tape's surface. These radicals are capable of reducing metal salts to the corresponding metal nanoparticles. In this way, the mechanically activated tape can be decorated with various types of nanoparticles, including Au, Ag, Pd, or Cu. While retaining their mechanical properties

and remaining "sticky," the tapes can exhibit new properties derived from the presence of metal nanoparticles (e.g., bacteriostaticity, increased electrical conductivity). They can also be patterned with nanoparticles only at selective locations of mechanical activation.