# New nanoparticle discovery may eliminate cold storage for some tests

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Many diagnostic tests use antibodies to help confirm a myriad of medical conditions, from Zika infections to heart ailments and even some forms of cancer. Antibodies capture and help detect proteins, enzymes, bacteria and viruses present in injuries and illnesses, and must be kept at a constant low temperature to ensure their viability—often requiring refrigeration powered by electricity. This can make diagnostic testing in underdeveloped countries, disaster or remote areas and even war zones extremely expensive and difficult.

A team of engineers from Washington University in St. Louis and Air Force Research Laboratory have discovered an inexpensive work-around: a protective coating that could completely eliminate the need for cold storage and change the scope of medical diagnostic testing in places where it's often needed the most.

"In many developing countries, electricity is not guaranteed," said Srikanth Singamaneni, associate professor of mechanical engineering and materials science in Engineering & Applied Science at Washington University in St. Louis.

"So how do we best get them medical diagnostics? We did not know how to solve this problem previously."

Singamaneni's team previously used tiny gold nanorods in bio-diagnostic research, measuring changes in their optical properties to quantify protein concentrations in bio-fluids: the higher a concentration, the higher the likelihood of injury or disease.

In this new research, published in *Advanced Materials*, Singamaneni worked with faculty from Washington University's School of Medicine and researchers from the Air Force Research Lab to grow metal-organic frameworks (MOFs) around antibodies attached to gold nanorods. The crystalline MOFs formed a protective layer around the antibodies and prevented them from losing activity at elevated temperatures. The protective effect lasted for a week even when the samples were stored at 60°C.

"This technology would allow point-of-care screening for biomarkers of diseases in urban and rural clinic settings where immediate patient follow-up is critical to treatment and wellbeing," said Dr. Jeremiah J. Morrissey, professor of anesthesiology, Division of Clinical and Translational Research, Washington University School of Medicine and a co-author on the paper.

"On the spot testing eliminates the time lag in sending blood/urine samples to a central lab for testing and in tracking down patients to discuss test results. In addition, it may reduce costs associated with refrigerated shipping and storage."

The protective MOF layer can be quickly and easily removed from the antibodies with a simple rinse of slightly acidic water, making a diagnostic strip or paper immediately ready to use. Singamaneni says this proof of concept research is now ready to be tested for clinical samples.

"As long as you are using antibodies, you can use this technology," said Congzhou Wang, a postdoctoral researcher in Singamaneni's lab and the paper's lead author. "In bio-diagnostics from here on out, we will no longer need refrigeration."

"The MOF-based protection of antibodies on sensor surfaces is ideal for preserving biorecognition abilities of sensors that are designed for deployment in the battlefield," said Dr. Rajesh R. Naik, 711th Human Performance Wing of the Air Force Research Laboratory, Wright-Patterson Air Force Base, and a co-corresponding author of the paper. "It provides remarkable stability and extremely easy to remove right before use."

**More information:** Congzhou Wang et al. Metal-Organic Framework as a Protective Coating for Biodiagnostic Chips, *Advanced Materials* (2016). DOI: 10.1002/adma.201604433

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