HealthManagement
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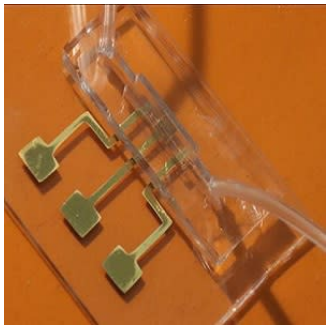
COVID-19 Antibody Detection in 10-12 Seconds



Researchers at Carnegie Mellon University report findings on an advanced nanomaterial-based biosensing platform that detects, within seconds, antibodies specific to SARS-CoV-2. The platform also helps quantify patient immunological response to the new vaccines with precision.

The testing platform identifies the presence of two of the virus' antibodies, spike S1 protein and receptor binding domain (RBD), in a very small drop of blood (about 5 microlitres). Antibody concentrations can be extremely low and still detected below one picomolar (0.15 nanograms per millilitre). This detection happens through an electrochemical reaction within a handheld microfluidic device which sends results almost immediately to a simple interface on a smart phone.

According to Rahul Panat, an associate professor of mechanical engineering at Carnegie Mellon, the researchers utilised the latest advances in materials and manufacturing such as nanoparticle 3D printing to create a device that rapidly detects COVID-19 antibodies.

A manufacturing technology called aerosol jet 3D printing is responsible for the efficiency and accuracy of the testing platform. Tiny, inexpensive gold micropillar electrodes are printed at nanoscale using aerosol droplets that are thermally sintered together. This causes a rough, irregular surface that provides increased surface area of the micropillars and an enhanced electrochemical reaction, where antibodies can latch on to antigens coated on the electrode. The specific geometry allows the micropillars to load more proteins for detection, resulting in very accurate, quick results.

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The test has a very low error rate because the binding reaction between the antibody and antigen used in the device is highly selective. The researchers were able to exploit this natural design to their advantage.

The results come at an urgent time during the COVID-19 pandemic. However, rapid diagnosis for the treatment and prevention of communicable diseases is a public health issue that goes beyond the current COVID-19 pandemic. Because the proposed sensing platform is generic, it can be used for the rapid detection of biomarkers for other infectious agents such as Ebola, HIV, and Zika. Such a quick and effective test could be a game-changer for controlling the spread of diseases.

Source: Advanced Materials
Image Credit: Advanced Manufacturing and Materials Lab, College of Engineering, Carnegie Mellon University

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