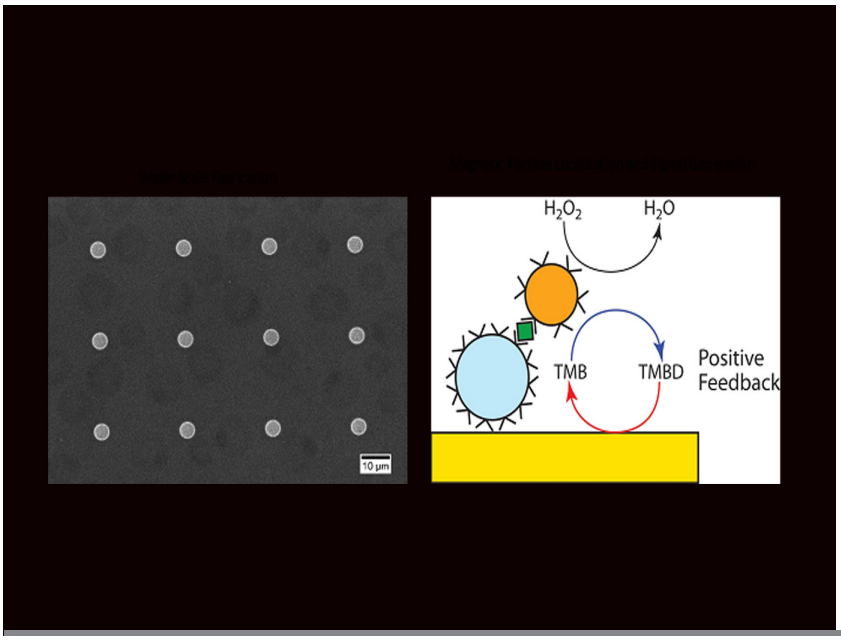


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Health, Medicine and Biotechnology

Electrochemical Sensors Based on Enzyme-Linked Immunosorbent Assay

Electrochemical ELISA Microelectrode Array Biosensor

Biological assays are ever evolving to move towards lower limits of detection and improved sensitivity. Improvements in trace biological molecule detection can have significant impact in healthcare, food safety and environmental safety industries. Detection of trace biological molecules can be critical to the diagnosis of early onset of diseases or infections. Researchers at NASA Ames Research Center developed an electrochemical, bead-based biological sensor based on Enzyme-Linked Immunosorbent Assay (ELISA) combining a magnetic concentration of signaling molecules and electrochemical amplification using wafer-scale fabrication of microelectrode arrays. Originally developed for the detection of the SARS-CoV-2 nucleoprotein, this invention can be easily modified to detect other environmental or human health biomarkers.

BENEFITS

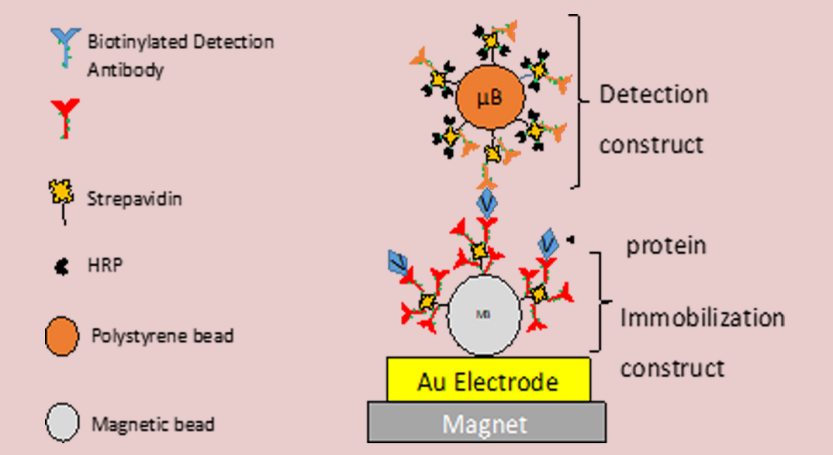
- Trace biological molecule detection
- 6.75-fold increased measured signal
- 35.7-fold increased signal sensitivity
- Simultaneous detection of two or more biological molecules
- Magnetic concentration and enrichment of electrochemical signal

THE TECHNOLOGY

NASA's electrochemical Enzyme-Linked Immunosorbent Assay (ELISA) microelectrode array biosensor advantageously incorporates a microbead detection construct, coupled with a magnetic immobilization construct, which substantially increases the signal sensitivity of a sensor. The magnetic immobilization construct draws the microbead detection construct to an electrode detection surface, enhancing signal sensitivity. By concentrating the signaling molecules close to the electrode detection surface, electrochemical redox cycling is achieved by reducing the distance between the two, allowing for regeneration of reporter molecules.

Whereas a traditional ELISA testing exhibits five to ten signaling molecules per probe molecule binding event, the present electrochemical ELISA-based biosensor testing exhibits up to 4,857 signaling molecules per probe molecule binding event. The model bead construct exhibits a more than 6.75-fold in increased measured signal, and more than 35.7-fold improvement in signal sensitivity. When compared to traditional optical ELISA, the present invention improves the limit of detection by up to a factor of 60.5.

NASA's electromagnetic ELISA-based biosensor can be used for the detection of SARS-CoV-2 virus to enhance Covid-19 testing during the early phases of infection. The technology may also be modified to detect other biomarkers.



Electrochemical ELISA Schematic

APPLICATIONS

The technology has several potential applications:

- Biomedical diagnostic devices market
- Electrochemical biosensors market
- Point-of-care diagnostics market

PUBLICATIONS

Patent Pending

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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