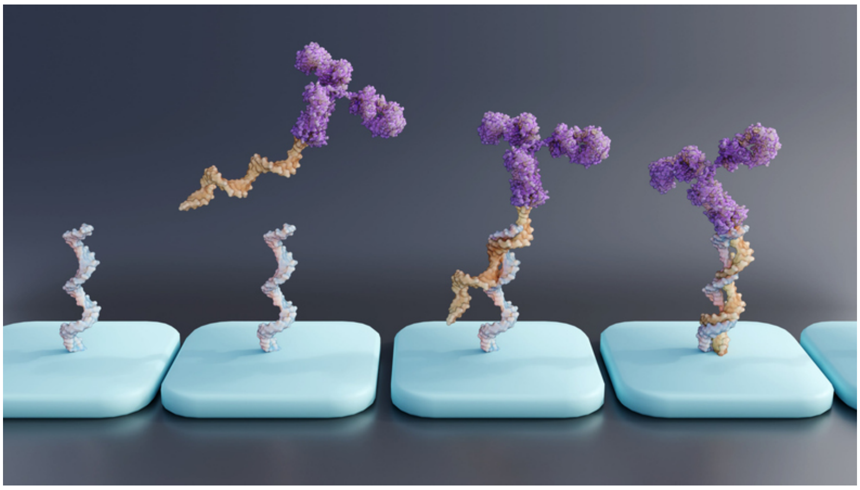
Terahertz DNA Bio-Sensor Architecture Comprising Doubly-Corrugated Spoofed Surface Plasmon Polariton Waveguide

Technology Number: 5568



OVERVIEW

Label-free Mach-Zehnder interferometer-based biosensor for molecular detection

- Detects molecular binding without fluorescent tags, reducing preparation and increasing efficiency
- DNA hybridization, biodefense, food processing, medical diagnostics

BACKGROUND

Biosensing is increasingly critical in industries like biodefense, food processing, medicine, and DNA research. Traditional biosensors often rely on fluorescent tags to detect molecular interactions. While effective, these fluorescent tag-based sensors have notable drawbacks, including time-consuming preparation, the potential to alter the system they are meant to analyze, and limited sensitivity. These shortcomings make real-time, rapid, and accurate detection difficult, necessitating a more efficient and less intrusive method. A label-free biosensor can address these issues by detecting molecular bindings directly, without additional tags. This approach significantly simplifies the sensor preparation process and allows for more precise, non-invasive analysis. Hence, there is a growing need for innovative technologies that can overcome the limitations of conventional methods and enhance biosensing capabilities across various critical fields.

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Category
Hardware
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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INNOVATION

Researchers at the University of Michigan have developed a novel label-free biosensor using a Mach-Zehnder interferometer (MZI) that leverages subwavelength terahertz (THz) waveguide technology. This biosensor can detect molecular bindings based on shifts in the refractive index, eliminating the need for conventional fluorescent tags. In theoretical and computational studies, the sensor demonstrated high sensitivity by detecting refractive index changes from 1.05 to 1.15 during DNA hybridization. This robust sensitivity promises significant improvements in the field of molecular detection. Real-world applications extend across DNA hybridization detection, biodefense, food processing, and medical diagnostics. Advantages include non-invasive detection, strong sensitivity to small refractive index changes, and simplified sensor preparation, making this biosensor a valuable tool for numerous scientific and industrial applications.

ADDITIONAL INFORMATION

US8837036 "Dynamic terahertz switch using periodic corrugated structures"