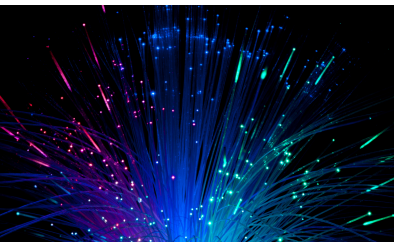


Single-Molecule Detection via Nanoscale Motion

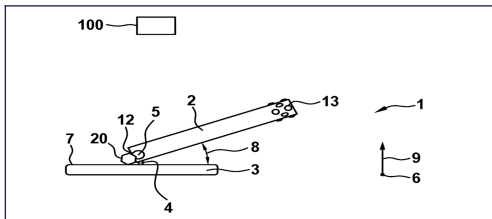
Many nanosensors require a target molecule to bind simultaneously to multiple receptors, limiting sensitivity and excluding small or single-epitope analytes. This technology uses a single binding event to mechanically restrict the movement of a nanoscale structure. The resulting change can be detected optically, by fluorescence, FRET or surface plasmon resonance.



DNA Origami Sensor Converts Binding into Motion

The sensor consists of two mobile structures connected by a nanoscale joint or hinge. A target-specific binding element is positioned so that molecule binding restricts the relative rotation or pivoting of the structures. Time-resolved tracking of a fluorescent marker, FRET signal or plasmonic response reveals the transition from the unbound to the bound state.

- 01 Single binding event can produce a measurable mechanical signal
- 02 Suitable for small molecules and single-epitope targets
- 03 DNA origami enables nanoscale design and precise receptor positioning
- 04 Compatible with fluorescence, FRET and plasmonic readouts



Target-induced restriction of nanosensor mobility. The sensor device (1) comprises a mobile nanostructure (2) connected to a second structure (3) by a joining portion (4). Binding of the target molecule (20) to the binding structure (5) restricts rotation around the axis (6) and limits the elevation angle (8). Fluorescent markers (13) enable detection of this mobility change by the detecting means (100).

IP RIGHTS

EP and US filed

2024

CHALLENGE

Conventional nanosensors often rely on dual-receptor or sandwich architectures. Detection therefore requires sufficiently large molecules with two suitable binding sites, such as two epitopes. Small molecules, nucleic acids or single-epitope targets may not generate a sufficient signal. In addition, many existing sensors measure intensity changes rather than directly resolving the molecular motion underlying the detection event.

INNOVATION

The technology introduces a mechanically responsive nanosensor in which one binding structure per joint is sufficient to generate a detectable signal. Target binding changes or limits the destruction-free mobility between two nanostructures, for example by blocking a hinge or reducing a defined rotation angle. DNA origami can be used to precisely position the structures, hinges, receptors and optical labels. Detection is possible through single-molecule fluorescence tracking, FRET or surface plasmon resonance, enabling flexible sensor formats for different analytes and readout platforms.

01 Basic principles observed · 02 Technology concept formulated · 03 Experimental proof of concept · 04 Technology validated in lab · 05 Technology validated in relevant environment · 06 Technology demonstrated in relevant environment · 07 System prototype demonstrated in operational environment · 08 System complete and qualified

TRL 08

TRL 07

TRL 06

TRL 05

TRL 04

TRL 03

TRL 02

TRL 01

Technology Readiness Level (TRL)



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Bayerische Patentallianz GmbH
Dr. Nicola Hoesch
 nhoesch@baypat.de
 +49 (0)89 5480177-29
 Prinzregentenstr. 52
 80538 München

