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The 1st TiN Plasmonic Lab-on-Chip Biosensor

Rafael Biotechnology Co., Ltd.
www.rafaelbiotech.com

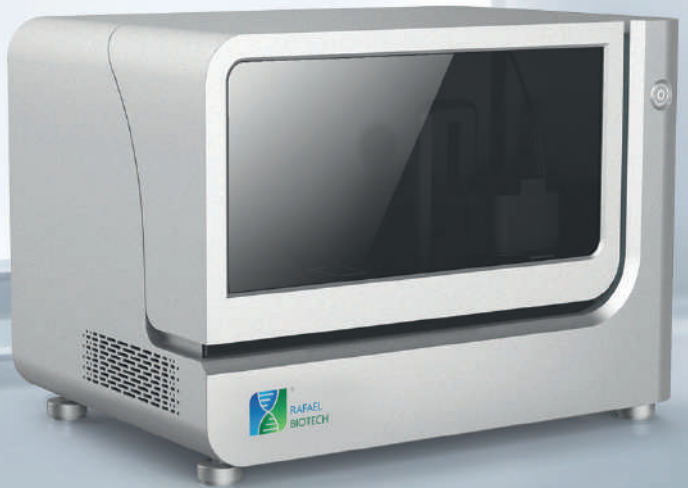
The 1st TiN Plasmonic Lab-on-Chip Biosensor [1, 2]

Quantitative real-time label-free biosensing of molecular interactions with

- Localized surface plasmon resonance (LSPR) of titanium nitride nanocubes;
- Massive parallel detection of over 144 channels per chip;
- Simplified functionalization chemistry;
- Optical measurement via interferometry;
- Friendly user interface;
- Automated functionalization with robotic dispenser.

Specifications[3]:

- 12 x 12 channels per chip with total target volume to 100 microliters
- < 100 nanoliters functionalization volume for each receptor species
- Biotinylation for receptor species before experiment
- Detection time is less than 15 minutes (Biotin-Streptavidin interaction)



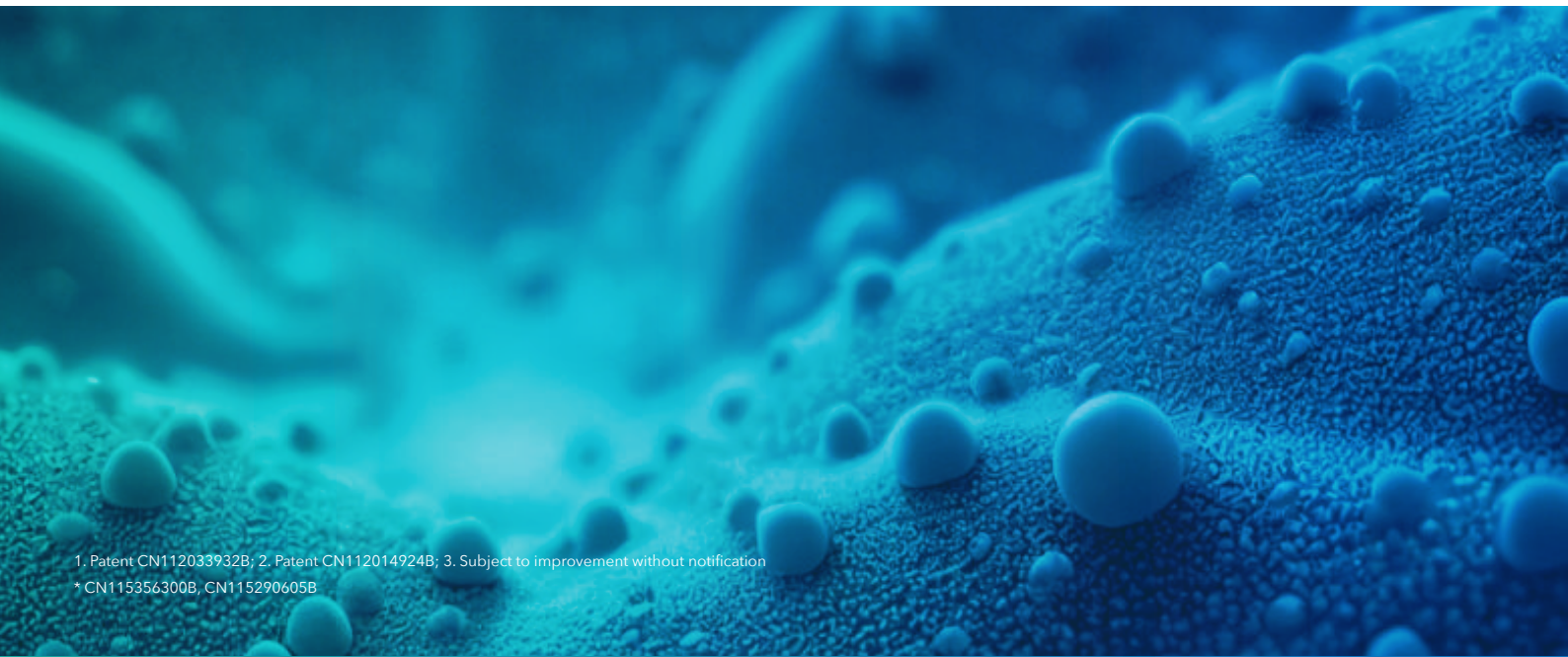
1. Patent CN112033932B; 2. Patent CN112014924B; 3. Subject to improvement without notification

* CN115356300B, CN115290605B

The 1st TiN Plasmonic Lab-on-Chip Biosensor 1, 2

Technical specifications and characteristics[3]

Name	PLoC 12[2] System
Type	Label-free Analytical Biosensor
Detection technology	Localized Surface Plasmon Resonance Imaging (LSPRi)
Data presentation	Real-time sensorgrams of binding kinetics or statics of binding events
Analysis style	Microfludic array with optical phase measurement
Analysis time	15 to 20 minutes per cycle
Number of flow cells	12 x 12 = 144 cells in microfluidic array
Number of sensor spots	1 to 144 (application-dependent)
Sample type	Small molecules to macromolecules in various fluidic conditions (e.g. heavy metal ions in water, exosome in serum, RNA in DEPC-treated water, etc.)
Sample volume	100 uL for 144 analyses simultaneously
Injection volume	360 to 720 uL
Flow rate range	5 to 250 uL/min
Flow cell volume	100 nL per well
Data acquisition rate	1 Hz @ 4056 x 3040 pixels or 4 Hz @ 2028 x 1520 pixels (32 bit per pixel)
Sample capacity	3 or 7 samples with automated degassing and injection (Larger sample capacity on request)
Typical run times	20 minutes for 144 interactions or 1 hour for 432 interactions



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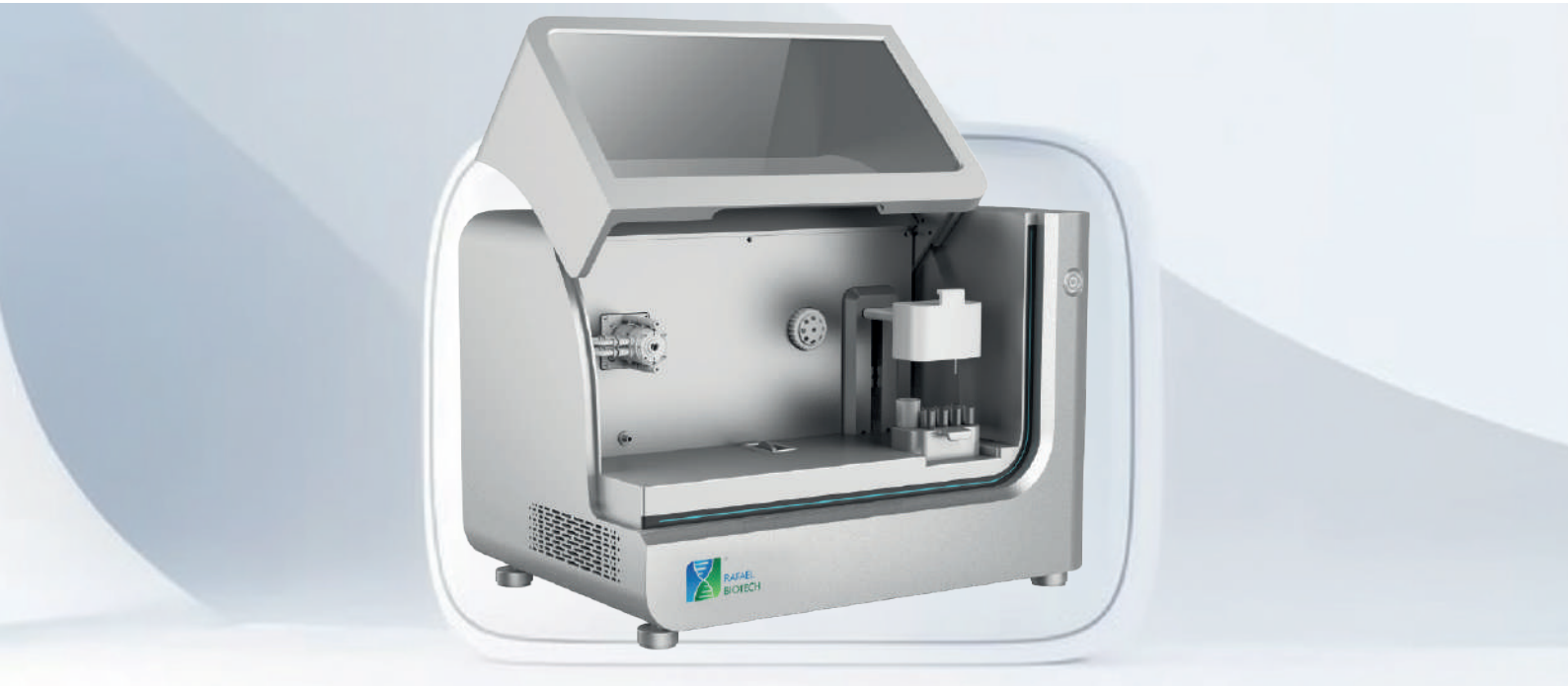
Technical specifications and characteristics[3]

Analysis temperature range	25°C to 37°C with standard option, 25°C to 75°C with thermoplasmonic option
Sample storage	4°C for functionalised biochips Room temperature for bare biochips
Sample refractive index range	1.33 to 1.47
Real-time reference subtraction	Automatic on demand
Analysis style	Microfludic array with optical phase measurement
Dimensions	350 mm x 550 mm x 190 mm
Net weight	25 kg
Mains requirement	100 to 240 V~, frequency 50/60 Hz
Power consumption	max. 50 VA with standard option max. 100 VA with thermoplasmonic option
Probe laser	Single mode 638 nm
Laser emission	optical power 50 mW in test compartment optical power 0.01 mW with enclosure in operation
Pump LED* (* for thermoplasmonic option only)	Peak wavelength 590 nm
LED emission*	optical power 1 W in test compartment optical power 0.01 mW with enclosure in operation



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Typical range of kinetic measurement[3]

Association rate (k_a)	Macromolecule: up to 1 x 10^9 M^{-1} s^{-1} Small molecule: up to 1 x 10^7 M^{-1} s^{-1}
Dissociation rate (k_d)	10^{-6} to 10^{-1} s^{-1}
Sample concentration	> 1 femtomolar (fM) for molecular weight less than 10 KDa; > 1 attomolar (aM) for molecular weight more than 100 KDa
Molecular weight	No lower limit for organic molecules
Short term noise	typically 0.03 radian (σ) for standard edition typically 0.01 radian (σ) for professional edition
Baseline drift	typically 0.03 radian per hour
Functionalization consumption	1 nM to 1 uM of each 100 nL droplet

Minimum computation requirements[3]

- Built-in CPU with 4 cores (standard edition)
- 8 GB internal memory
- 512GB solid-state hard drive space
- Screen resolution at least 1920x1080
- Gigabit Ethernet port for optional remote-data-analysis (RDA)

Remote data analysis (RDA) options[3]

- Ubuntu® LTS Server with CPU up to 64 cores
- 256 GB internal memory
- 28 TB hard drive space
- Gigabit Ethernet port for data transfer from instrument

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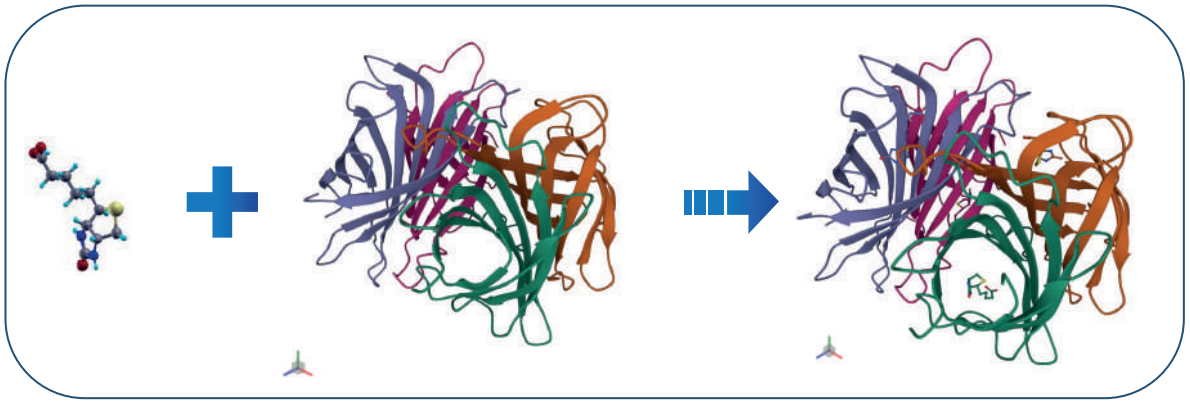
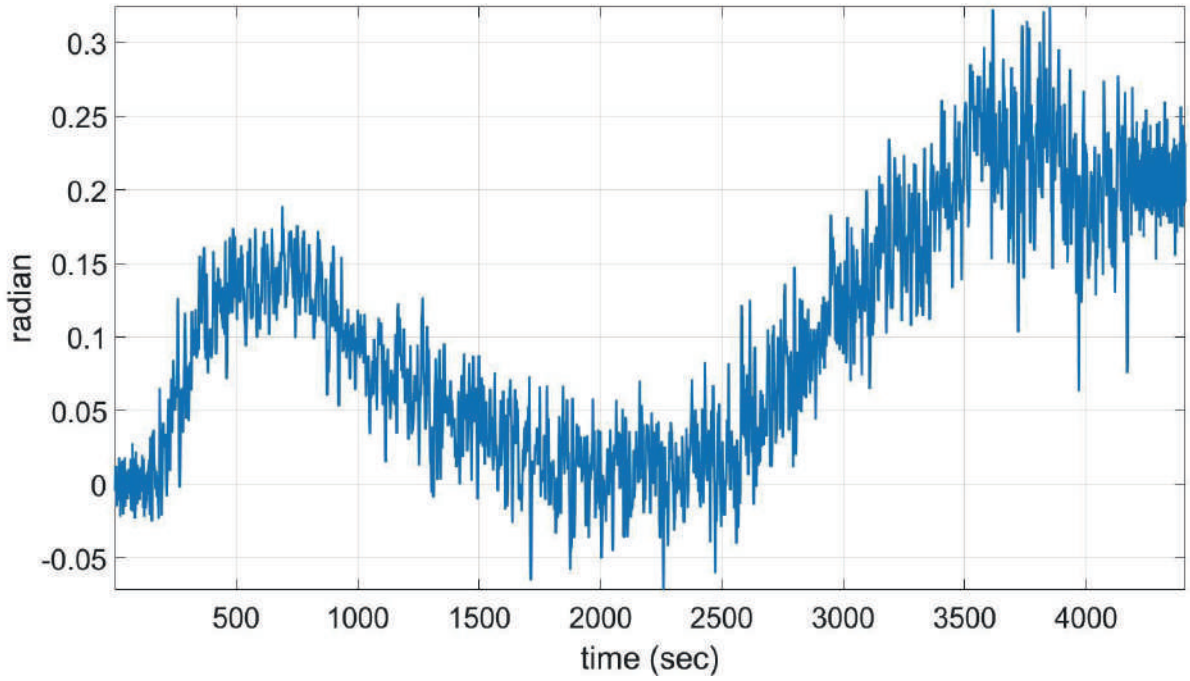
Demonstration of biosensing with Biotin-Streptavidin interaction:





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