Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Materials:

Microfabricated passive resonator biochip for sensitive radiofrequency detection and characterization of glucose†

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1. Response of the proposed sensor as a function of glucose concentrations

Table S1: Measurement results for different glucose concentrations.

Samples	Iteration 1		Iteration 2		Iteration 3		Mean ± Standard Error	
(mg·dL^{-1})	f_o	$\|S_{11}\|$	f_o	$\|S_{11}\|$	f_o	$\|S_{11}\|$	f_o (GHz)	$\|S_{11}\|$ (dB)
DI	0.541	-34.04	0.547	-33.037	0.541	-33.572	0.543±0.002	-33.549±0.289
50	0.596	-32.273	0.608	-31.810	0.590	-31.982	0.598±0.005	-32.022±0.135
75	0.657	-31.974	0.651	-31.214	0.663	-30.926	0.657±0.003	-31.371±0.312
100	0.706	-30.606	0.702	-29.323	0.706	-30.173	0.704±0.002	-30.034±0.376
125	0.767	-29.219	0.779	-29.423	0.761	-28.606	0.769±0.005	-29.082±0.245
150	0.816	-27.635	0.810	-28.126	0.816	-27.332	0.812±0.004	-27.698±0.231
175	0.877	-27.205	0.871	-27.137	0.871	-27.721	0.873±0.002	-27.355±0.184
200	0.939	-26.652	0.939	-25.472	0.946	-25.735	0.943±0.004	-25.953±0.357
225	1.006	-25.398	0.994	-23.389	0.994	-23.972	0.998±0.004	-24.253±0.597
250	1.049	-24.113	1.055	-22.679	1.043	-24.739	1.049±0.003	-23.843±0.609

f_o is in gigahertz, and $|S_{11}|$ is in decibels.

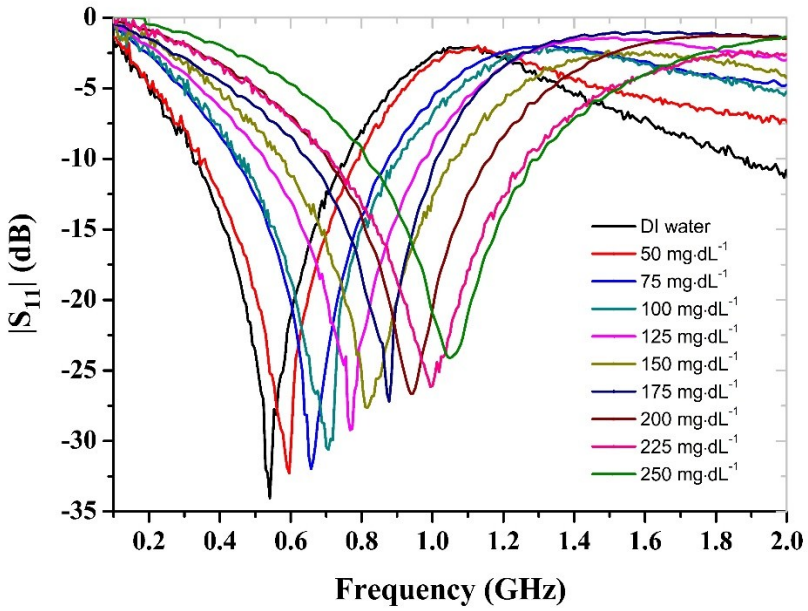

Fig. S1: RF response (first iteration) of the proposed sensor with respect to the different glucose concentrations.

2. Quantitative measures

A. Measurement of loaded quality factor (Q_L) and coupling coefficient (k)

$$Q_L = \frac{f_o}{B_{3-dB}}; B_{3-dB} = f_h - f_l$$

$$k = \frac{f_h^2 - f_l^2}{f_h^2 + f_l^2}$$

where f_h and f_l are the high- and low-frequency values of the 3-dB bandwidth and f_o is the fundamental resonance frequency of each sample.

B. Definition of limit of detection and limit of quantitation:

Limit of detection (LoD): The lowest amount of the analyte (here glucose concentration) in a sample which can be detected. The limit of detection in this study was calculated as follows:

LoD= (Standard Error in the resonance frequency corresponding to the glucose concentration/slope) * 3.3

Limit of quantitation (LoQ): The lowest amount of analyte (here glucose concentration) which can be quantitatively determined with suitable precision and accuracy.

LoQ= (Standard Error in the resonance frequency corresponding to the glucose concentration/slope) * 10

3. Reliability and selectivity

Table S2: Interference of sucrose in the resonance characteristics of the proposed glucose sensor.

Test*	Samples ($mg \cdot dL^{-1}$)	Concentration measured from proposed sensor ($mg \cdot dL^{-1}$)		Cohen's d-score
		Only glucose	Glucose + Sucrose (10 $mg \cdot dL^{-1}$)	((Mean (X)-Mean (Y))/σ_{XY})
1	100	98.20±0.4474	96.10±1.2675	1.4084
2	150	146.83±0.7064	146.01±0.7415	0.6497
3	200	203.27±0.8395	205.9215±0.6665	-2.0325

*- Each test was iterated three times with DI water treatment and subsequent surface drying

4. Reproducibility

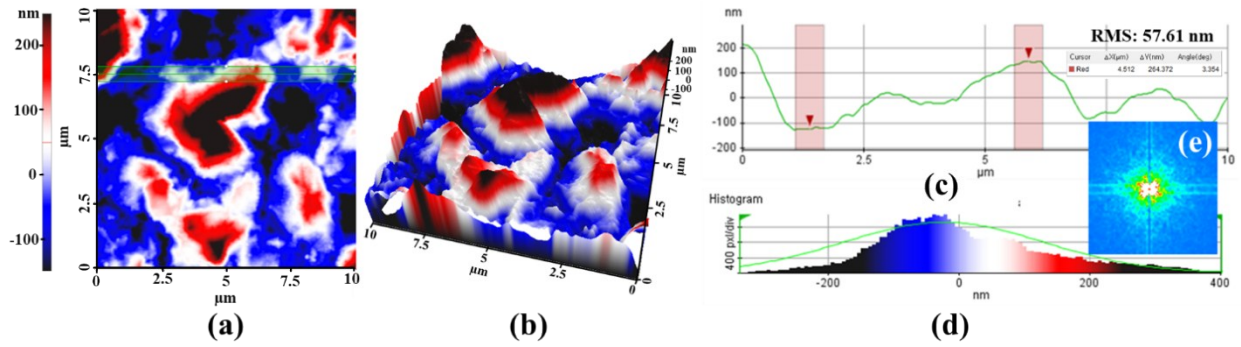

Fig. S2: Post-treatment surface morphology of the proposed sensor. (a) 2D and (b) 3D images of the exposed metal layer. (c) Surface roughness of the selected area showing a maximum variation of 254.372 nm of the selected region resulting in an RMS value of 57.61 nm [Fig. S2 (a)]. (d) Histogram plot of the overall measured sensor area (10 µm × 10 µm). (e) Power spectrum.