Electronic Supplementary Information

WHOLE-CELL DETECTION OF LIVE LACTOBACILLUS ACIDOPHILUS ON APTAMER-DECORATED POROUS SILICON BIOSENSORS

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Table S1. Results of $PSiO_2$ scaffold characterization.

Etching conditions		**HRSEM**		**Gravimetry**	**SLIM**	
Etching time (s)	Current density (mA/cm^2)	Pore Diameter (nm)	Thickness (nm)	Total Porosity (%)	Open Porosity (%)	Thickness (nm)
30	300	65 ± 10	5440 ± 80	78 ± 1	79 ± 1	4975 ± 88
375	24	25 ± 5	-	54.6 ± 1	52 ± 1	5172 ± 57

Porous Si films were tuned in terms of pore size and thus porosity, in order to improve optical properties. Smaller pore sizes result in a higher number of reflection interferences as the light beam is reflected on more pore walls which is represented by a higher number of Fabry-Pérot fringes in the sample reflectivity spectrum[1, 2]. In the electrochemical etching process of porous silicon, pore diameter decreases with decreasing current density. In order to change this parameter, but not the thickness of the porous film, the product of current density and etch time has to be kept in the same range so that the total charge passing through the sample stays constant[3, 4]. Therefore, the current density was lowered to 24 mA/cm^2 and the etch duration was extended accordingly to 375 seconds. The characterization of the resulting new $PSiO_2$ scaffold is presented in Table S1. Figure S1 shows HRSEM images of both the original macroporous structure and the tuned mesoporous PSi revealing the differences in pore size. The average pore diameter in the mesoporous transducer was reduced to 25±5 nm (as determined by HRSEM) while the average thickness of the porous layer was nearly unchanged (as determined by SLIM). In addition, the porosity of the porous layer was reduced, suggesting increased free surface area as expected.

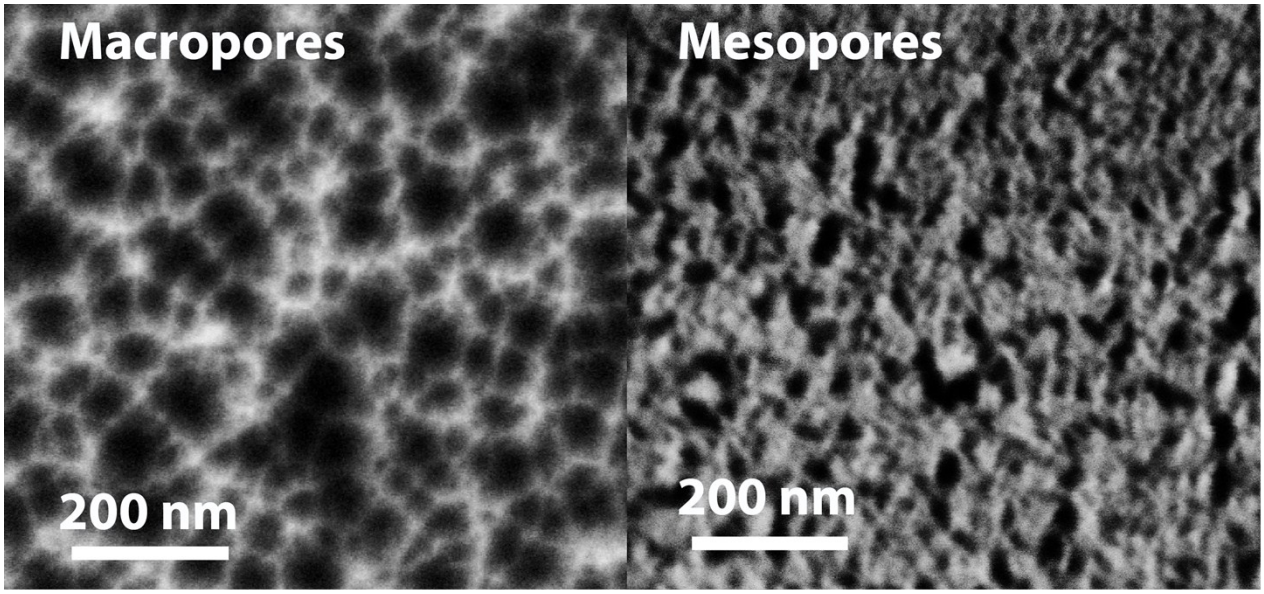

Fig S1. HRSEM top-view micrographs of porous silicon films obtained from etching conditions as listed in Table S1.

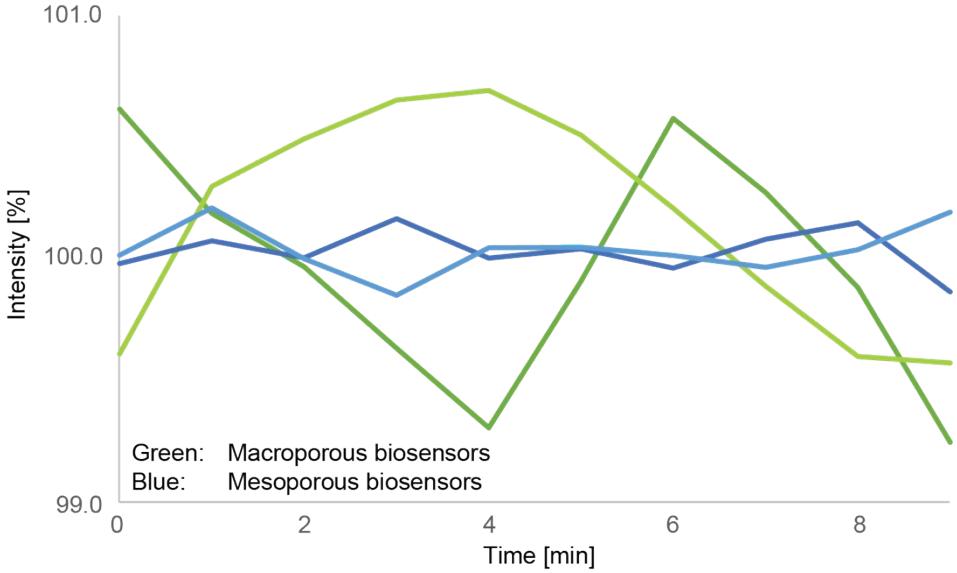

Fig S2. Typical baselines of aptamer-functionalized biosensors in SB prior to incubation with bacteria suspensions. Macroporous biosensors (green lines) show higher standard deviations between the measurements while the noise for mesoporous structures (blue lines) is significantly reduced.

Table S2. Signal-to-noise ratios calculated from baseline standard deviations and obtained biosensing signals with 10^7 cells/mL.

Biosensor structure	**Average noise** (%)	**Average signal (for 10^7 cells/mL)** (%)	**Signal-to-noise ratio**
Macroporous	0.5	5.5	11
Mesoporous	0.1	2.4	24

References:

1. S. Jang, *J. Chosun Natural Sci*, 2011, 5, 13-17.
2. M. J. Sailor, *Porous silicon in practice: preparation, characterization and applications*, John Wiley & Sons, 2012.
3. M. J. Sailor and E. C. Wu, *Advanced Functional Materials*, 2009, 19, 3195-3208.
4. E. Segal, L. A. Perelman, F. Cunin, F. DiRenzo, J. M. Devoisselle, Y. Y. Li and M. J. Sailor, *Advanced Functional Materials*, 2007, 17, 1153-1162.