Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

Quick and simple integration of optical oxygen sensors into glass-based microfluidic devices

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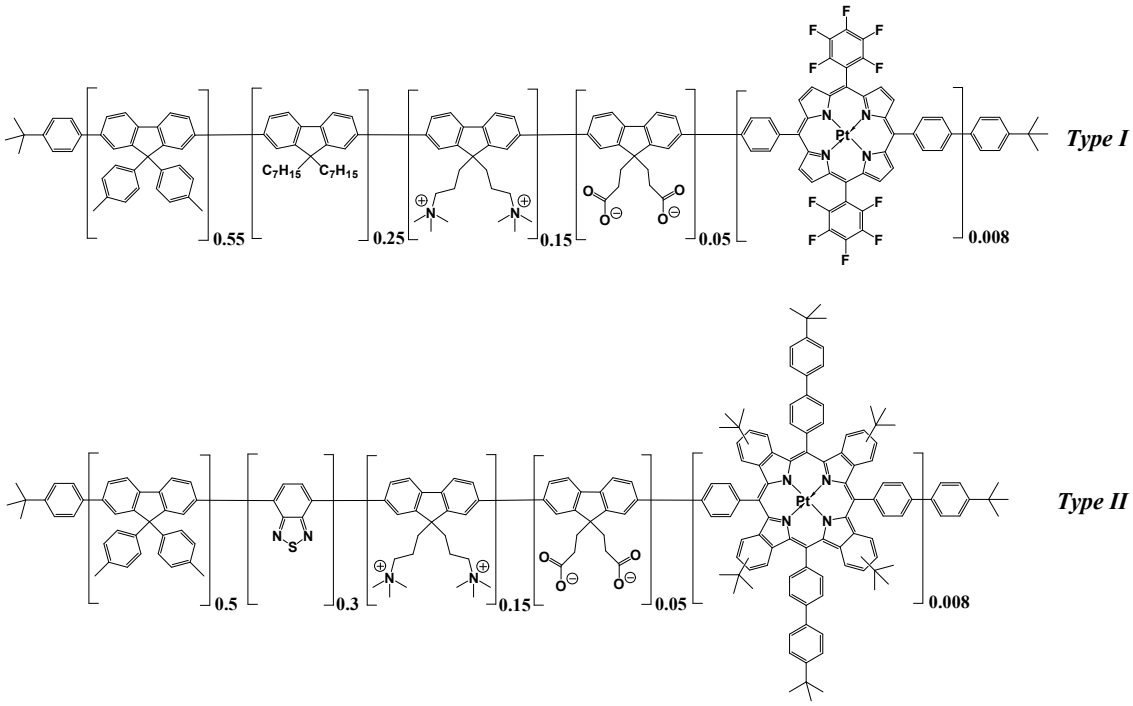

Figure S1. Chemical structures of the polymers used for preparation Type I and Type II nanobeads.

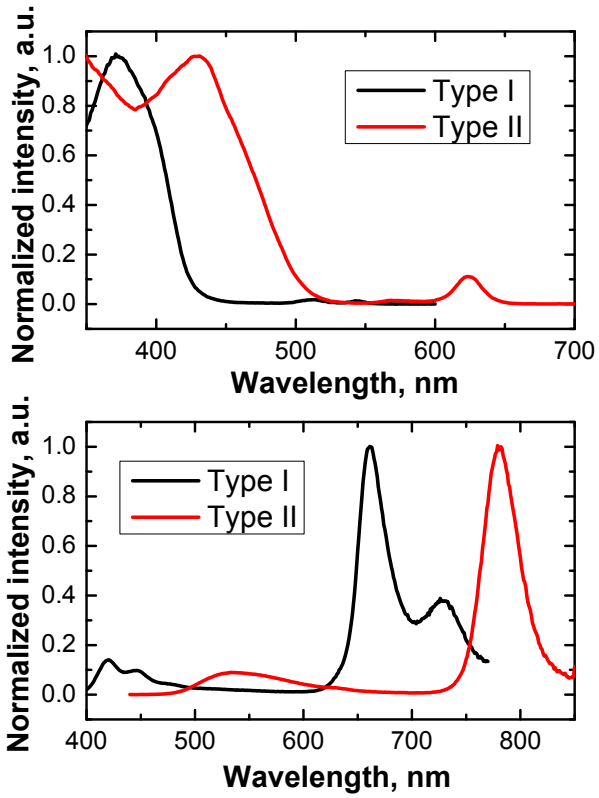

Figure S2. Optical properties of the type I and type II nanobeads in anoxic aqueous dispersion. Up: excitation spectra (λ_{em} = 670 and 780 nm for Type I and Type II,

respectively). Below: corrected emission spectra (λ_{exc} = 390 and 410 nm for Type I and Type II, respectively).

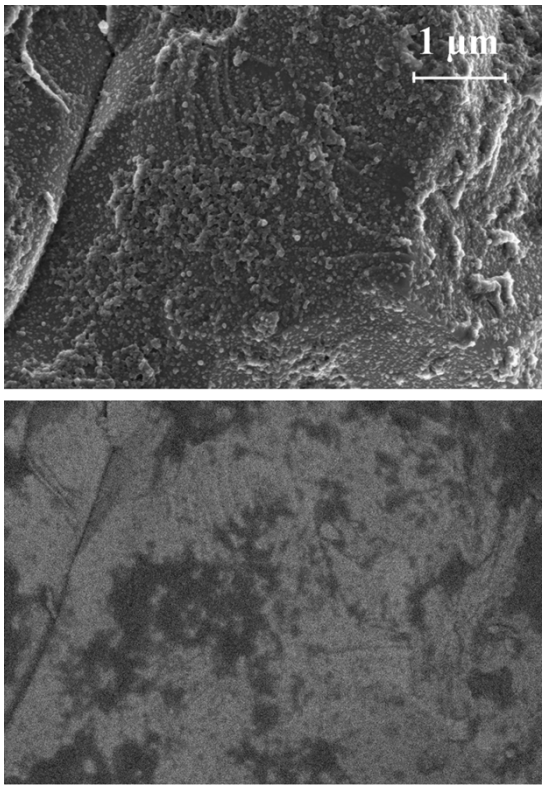

Figure S3. SEM Images of the powder-blasted glass surface modified with oxygen-sensitive nanoparticles captured with an In-Lens (up) and a backscattered electron (BSE, below) detector. Agglomerates of nanoparticles are visible with an In-Lens detector; the dark areas captured with the BSE detector indicate high accumulation of organic matter (conjugated polymer nanoparticles) whereas the lighter areas – glass surface with much less organic matter.

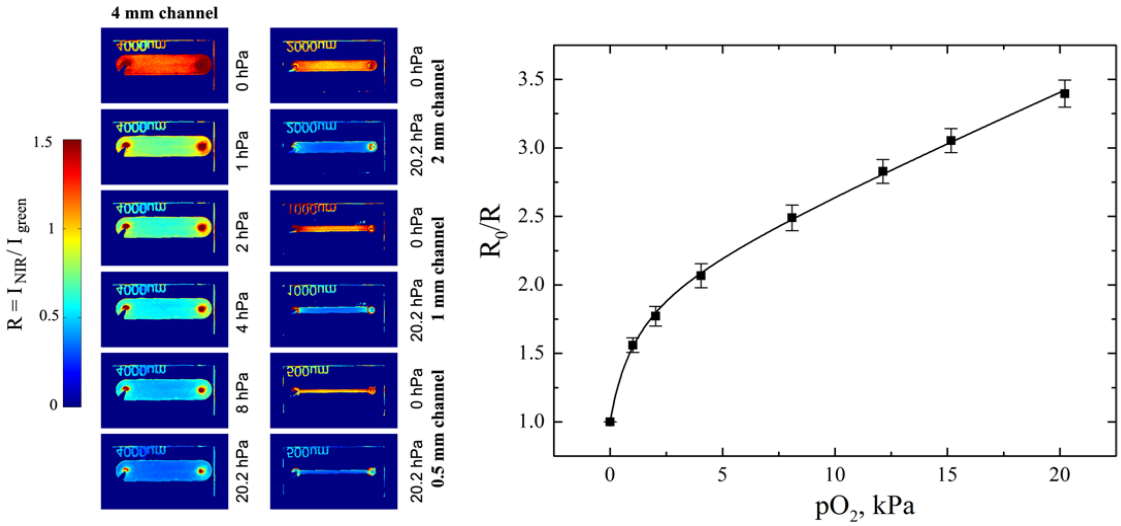

Figure S4. Left: false color images of luminescence intensity ratio distribution for the powder-blasted microfluidic chips with integrated nanoparticles of Type 2. The images were aquired with a dual chip RGB/NIR camera. Right: Stern-Volmer plot for luminescence intensity ratio (R_0 – ratio in the absence of oxygen) for the chips with 4 mm channel.

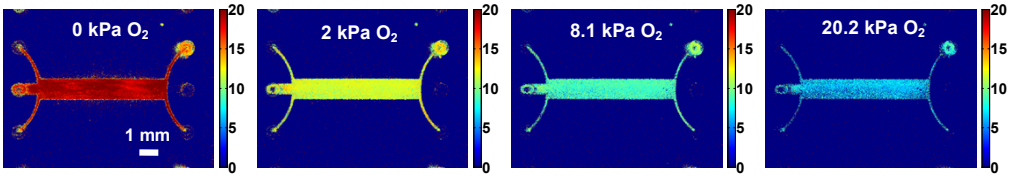

Figure S5. Lifetime images of the packed-bed reactors modified with silica microbeads and oxygen-sensitive nanoparticles of Type II obtained for the gas phase at 22 °C with a SensiCam CCD camera. The color bar is the decay time in µs.

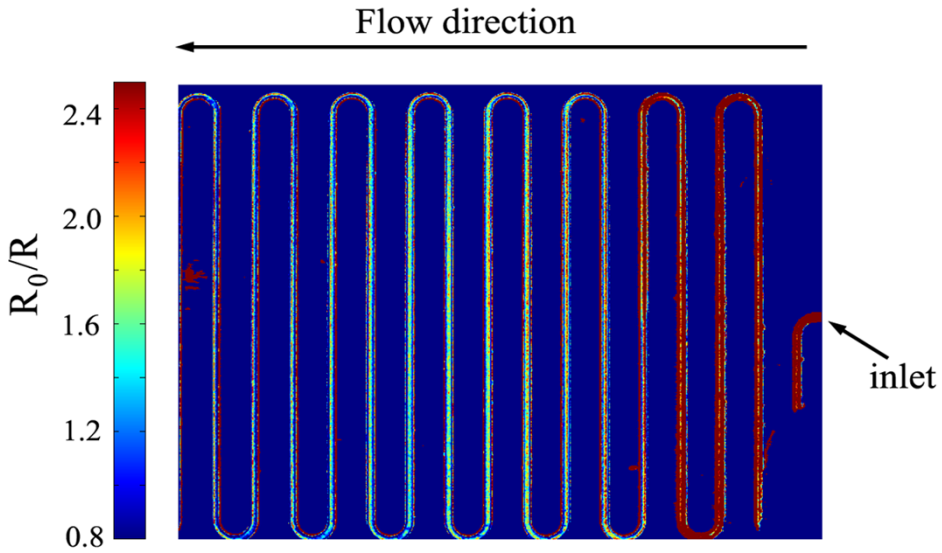

Figure S5. Monitoring of enzymatic oxygen consumption in a Miander chips. Air-saturated solutions of glucose (10 mg/mL) and glucose oxidase (0.05 mg/mL) are introduced simultaneously through the inlet at a flow rate of 10 mL/min and 2 mL/min, respectively. The luminescence is detected in the green and NIR channels of the dual chip camera under excitation with blue light. The false color image reflects the luminescence intensity ratio $R=I_{NIR}/I_{green}$, where R_0 is the ratio in the anoxic conditions and R is the ratio under experimental conditions. Low R_0/R values indicate nearly anoxic conditions whereas $R_0/R \sim 2.4$ corresponds to air saturation. The channel diameter is 150 µm.

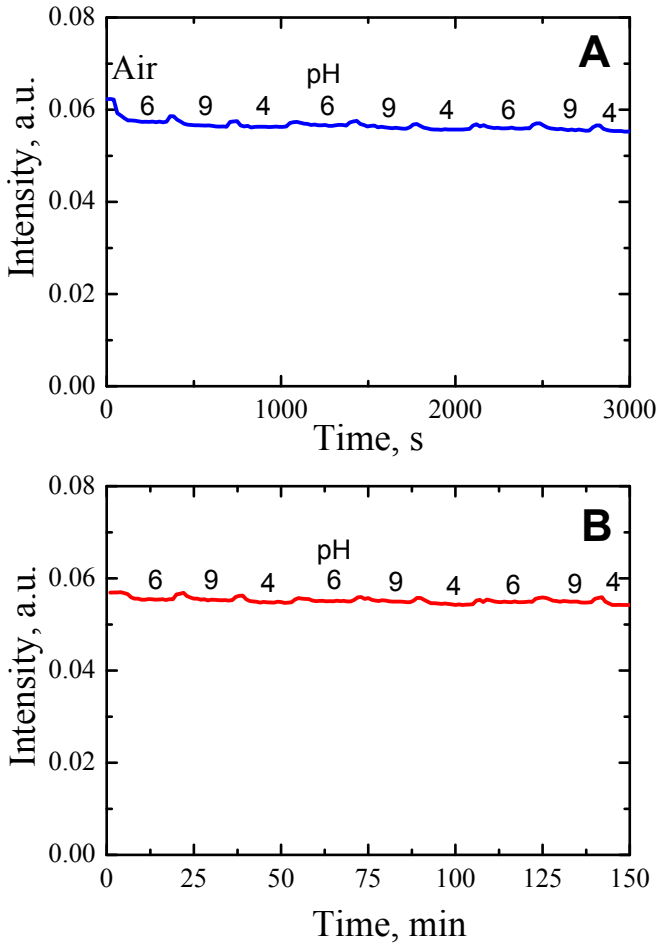

Figure S6. Stability of the oxygen sensor integrated into a powder-blasted chip under continuous flow of buffer solutions of different pH in the absence (A) and in presence of PEG-6000 (1% wt, B).