Enhanced terahertz sensitivity for glucose detection with a hydrogel platform embedded with Au nanoparticles: supplement

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1. Sensitivity calculation

Three separate measurements were made for deionized water as a standard sample with our THz-TDS system in transmission. As shown in Fig. S1 (a), the absorption spectra for the three measurements are almost indistinguishable over the bandwidth, and the absorption coefficient averaged over 0.2 to 1.5 THz, as plotted in Fig. S1 (b), has a standard deviation of 0.22 cm^{-1}. The standard deviation is used to calculate the LOD and saturation concentration of our sensing platform, as shown in Fig. S2 where N=0.22 cm^{-1}.
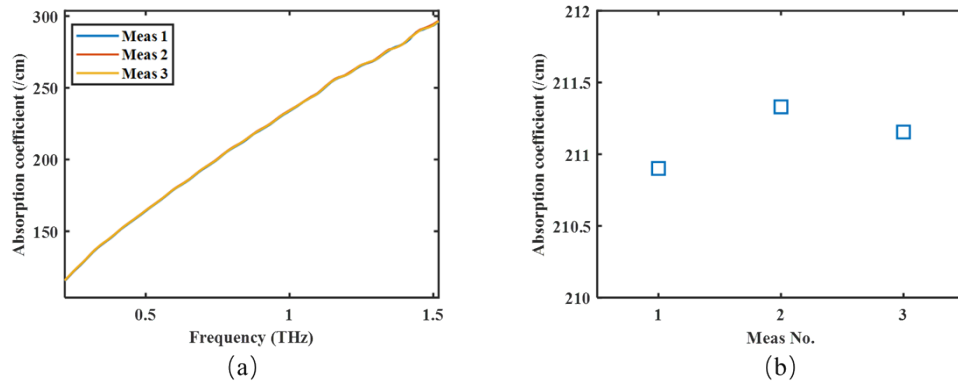

Fig. S1 (a) The absorption coefficient of water measured 3 times with our THz-TDS system. (b) The absorption coefficient for the three water measurements averaged over 0.2 to 1.5 THz.
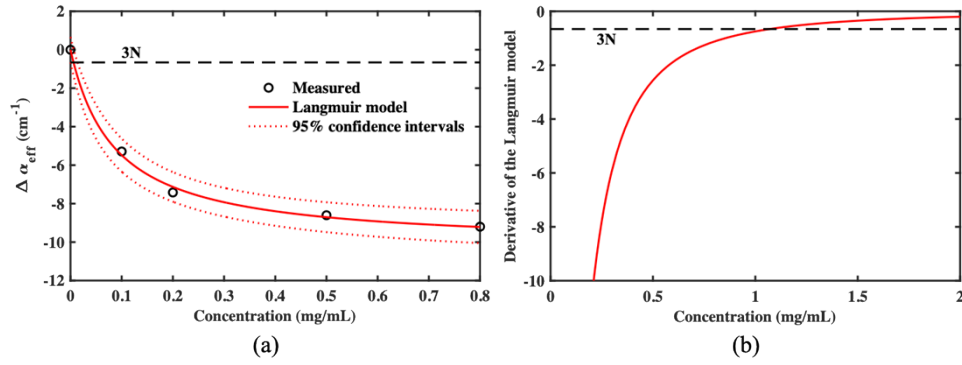
Fig. S2 (a) Langmuir model fitting of the measured signal and (b) The derivative of the Langmuir model. In both figures the line of 3N is indicated with a black dashed line.

2. The pH induced terahertz absorption decreasing verified with metamaterials

A polarization-insensitive metamaterial structure was used without modification from [1]. The ND@Au suspension was first dropped onto the metamaterial, followed by the addition of glucose solutions. The terahertz reflection measurements were carried out before, immediately after, 1 min after, and 15 min after adding glucose solutions. The terahertz beam incidents onto the substrate of the metamaterial from the bottom with a 30°C angle. The measured reflection R is calculated with R=20lg(E_{sam}/E_{ref}), where E_{sam} and E_{ref} are the Fourier-Transformed amplitude of the solution/metamaterial interface and the air/silicon substrate interface, respectively. Figure S3 shows a typical series of R calculated with Au^+glucose solutions of 10 mg/mL. ΔR acounts for the change of R at 0.56 THz compared to the immediate addition of glucose solutions.
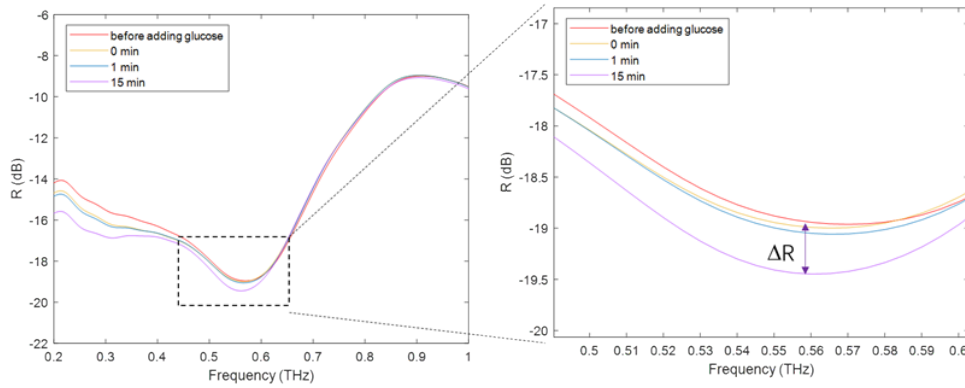

Fig. S3. A series of reflection spectra measured by adding 10mg/mL glucose solution in to ND@Au suspension. The spectra were taken before the reaction, and at 0, 1 min, and 15 min after reaction.

References

1. S. Wang, L. Xia, H. Mao, X. Jiang, S. Yan, H. Wang, D. Wei, H. Cui, and C. Du, "Terahertz Biosensing Based on a Polarization-Insensitive Metamaterial," IEEE Photonics Technol. Lett. vol. 28, pp. 986–989, 2016, https://doi.org/10.1109/LPT.2016.2522473