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Supporting Information

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Combining a Nanowire SERRS Sensor and a Target Recycling Reaction for Ultrasensitive and Multiplex Identification of Pathogenic Fungi

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Combining Nanowire SERRS Sensor and Target Recycling Reaction for Ultrasensitive and Multiplex Identification of Pathogenic Fungi

Seung Min Yoo[†], *Taejoon Kang*[†], *Hyungchang Kang, Hyoban Lee, Mijeong Kang, Sang Yup Lee*, and Bongsoo Kim**

[*] Prof. B. Kim, Dr. T. Kang, H. Kang, H. Lee, M. Kang
Department of Chemistry, KAIST
Daejeon, 305-701 (Korea)
E-mail: bongsoo@kaist.ac.kr

[*] Prof. S. Y. Lee, Dr. S. M. Yoo
Department of Chemical and Biomolecular Engineering (BK21 Program), KAIST
Daejeon, 305-701 (Korea)
E-mail: leesy@kaist.ac.kr

[†]These authors contributed equally to this work.

Experimental Details

Detection Limit of NW-on-film SERRS Sensor. Figure S1a shows plot of SERRS intensities of 1580 cm^{-1} band *versus* concentrations of tAsp DNA in the mixture of three different DNAs (tCgla, tCkru, and tCneo). NW-on-film sensor could detect correct target DNA without the changing of sensitivity, even if target DNA was mixed with noncomplementary DNAs in solution.

Figure S1b shows the detection limit of this sensor by employing long *A. fumigatus* DNA (307 bp). The detection limit was not affected by the length of target DNA.

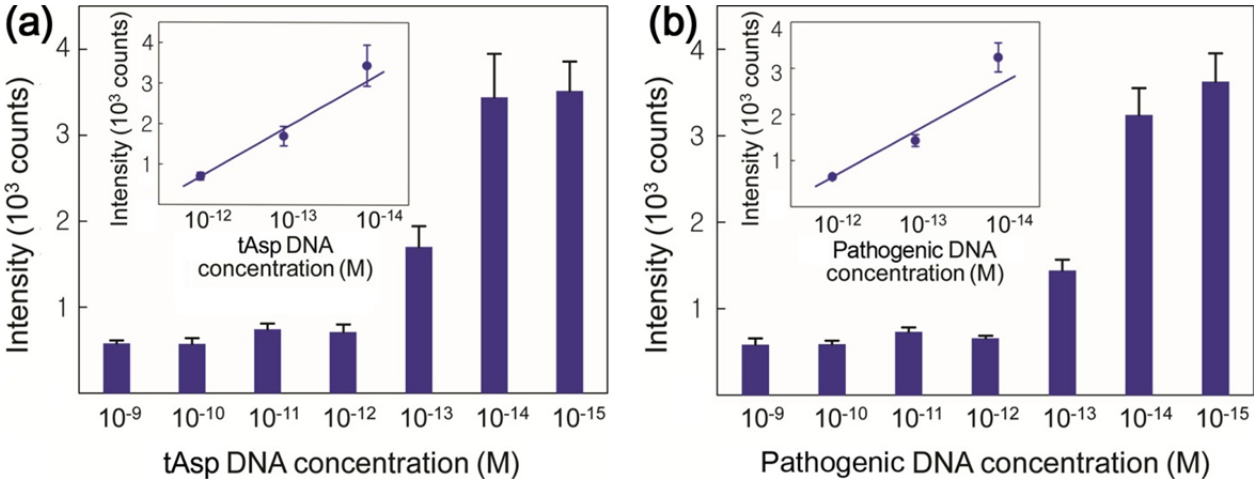

Figure S1. (a) Plot of SERRS intensities of 1580 cm^{-1} band *versus* concentrations of tAsp DNA in the mixture of three different DNAs (tCgla, tCkru, and tCneo). The concentrations of three noncomplementary DNAs were fixed at 100 nM and the concentration of tAsp DNA was only varied. (b) Plot of SERRS intensities of 1580 cm^{-1} band *versus* concentrations of pathogen DNA (*A. fumigatus*).

Diagnosis of Clinical Samples. We tested eight real clinical samples by using NW-on-film SERRS sensor. Among eight samples, five samples are determined to *A. fumigatus* and three samples to *C. glabrata*. This result is perfectly agreed to those obtained by culture-based assay. The identification of pathogens without false positive signal makes this sensor useful for diagnosis of various infectious diseases.

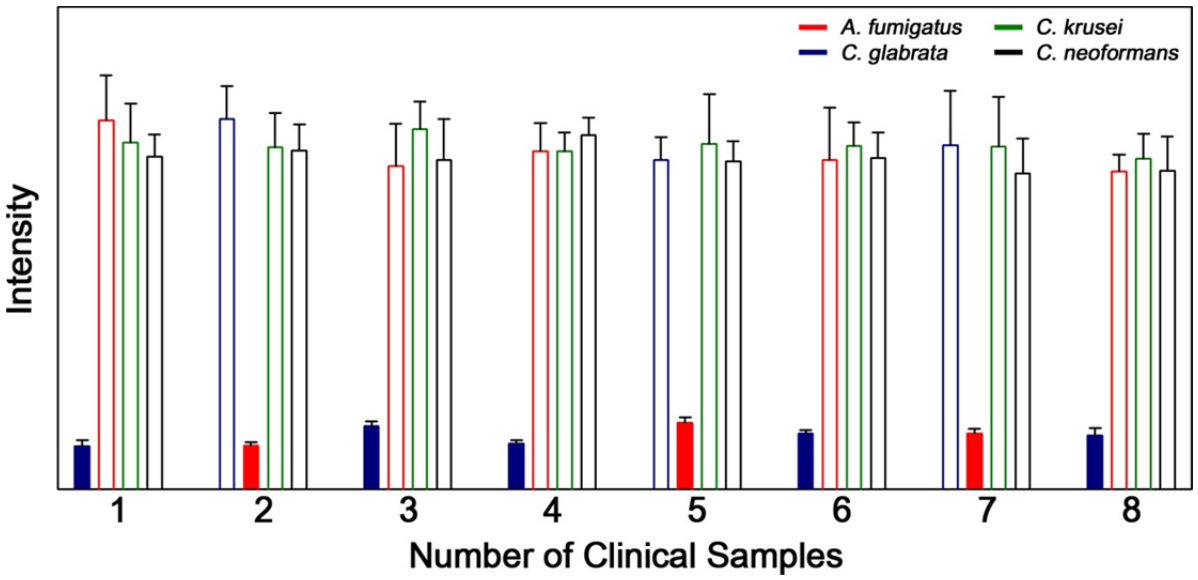

Figure S2. Identification of pathogenic fungal DNAs by using NW-on-film sensor. The target DNAs were extracted from eight clinical samples. Among eight samples, five samples are determined to *A. fumigatus* and three samples to *C. glabrata*.

Absorption Spectrum of Au NWs. We measured absorption spectra of Au NWs using a UV-vis spectrometer (JASCO, Japan). For the measurement, as-grown Au NWs were transferred to a quartz substrate and the absorption spectrum was obtained from NWs ensemble. The spectra show peaks near 570 nm.

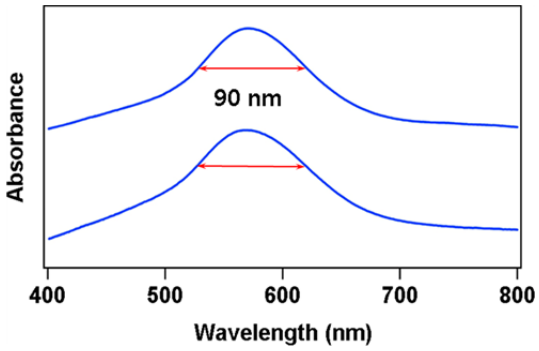

Figure S3. UV-vis absorption spectra of Au NWs.

Table S1. Fungal species and target gene used in this study.

Species	Target gene (copy number)
Aspergillus fumigatus (KCCM 60027)	18S rDNA (38-91)[a]
Cryptococcus neoformans (KCTC 7003)	18S rDNA (2)[b]
Candida glabrata (KCCM 50044)	18S rDNA (1)[b]
Candida krusei (KCCM 50563)	18S rDNA (-)[c]

[a]Reported by previous study[1]

[b]Hit(s) obtained by BLAST search (NCBI genome database)

[c]Not known (no hit) because the lack of genome sequence

References

[1] M. L. Herrera, A. C. Vallor, J. A. Gelfond, T. F. Patterson, B. L. Wickes, *J. Clin. Microbiol.* **2009**, *47*, 1325.

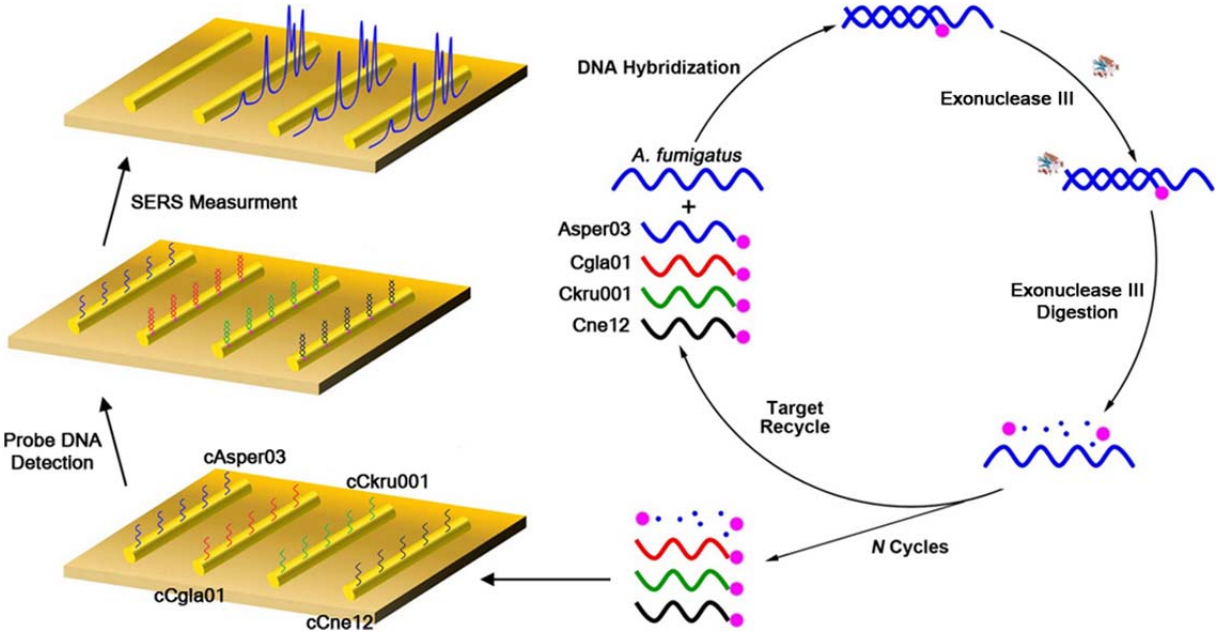

Figure S4. Color version of Figure 1. Schematic representation for the identification of pathogenic fungal DNAs by patterned NW-on-film SERRS sensor coupled with exonuclease III-assisted target recycling reaction.

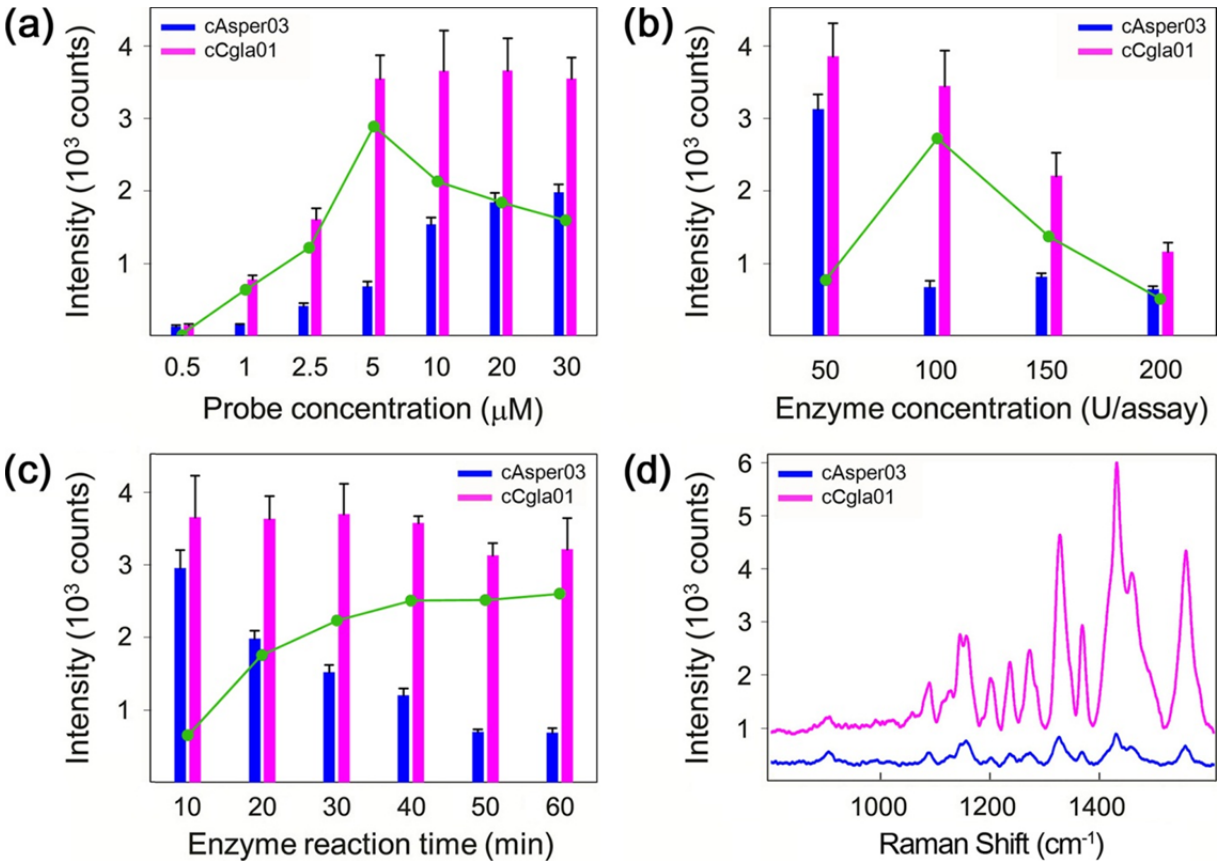

Figure S5. Color version of Figure 2. Determination of the optimal conditions for exonuclease III-assisted target recycling reaction. The blue and magenta bars represent the SERRS intensities of 1580 cm^{-1} band measured from cAsper03 and cCgla01-modified NW-on-film structures, respectively. Green line represents the difference of two SERRS intensities. (a) Effect of probe DNA concentration on SERRS intensity. Target DNA (tAsp) was incubated with different concentration of probe DNAs (Asper03 and Cgla01; 0.5, 1, 2.5, 5, 10, and 30 μM) in solution containing exonuclease III. (b) Effect of enzyme concentration on SERRS intensity. The probe (Asper03 and Cgla01) and target (tAsp) DNAs were incubated with various concentrations of exonuclease III (50, 100, 150, and 200 U/assay). (c) Effect of reaction time on SERRS intensity. The probe (Asper03 and Cgla01) and target (tAsp) DNAs were incubated with exonuclease III for different reaction times (10, 20, 30, 40, 50, and 60 min). (d) SERRS spectra of Cy5 obtained from cAsper03 and cCgla01-modified Au NW-on-film sensors under optimized conditions.

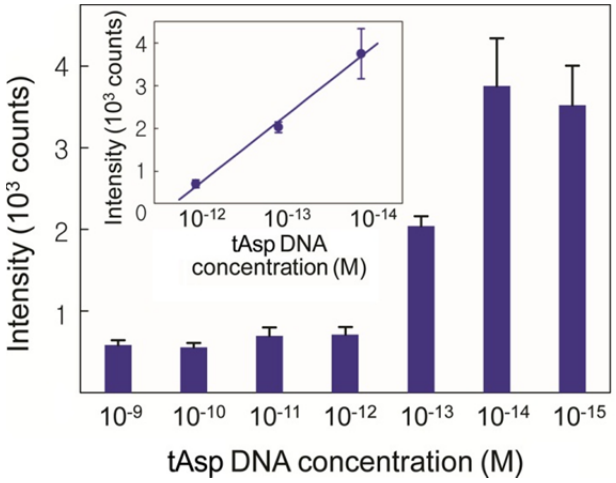

Figure S6. Color version of Figure 3. Plot of SERRS intensities of 1580 cm^{-1} band *versus* concentrations of target DNA (tAsp). Inset shows a dynamic range and linearly fitted line.

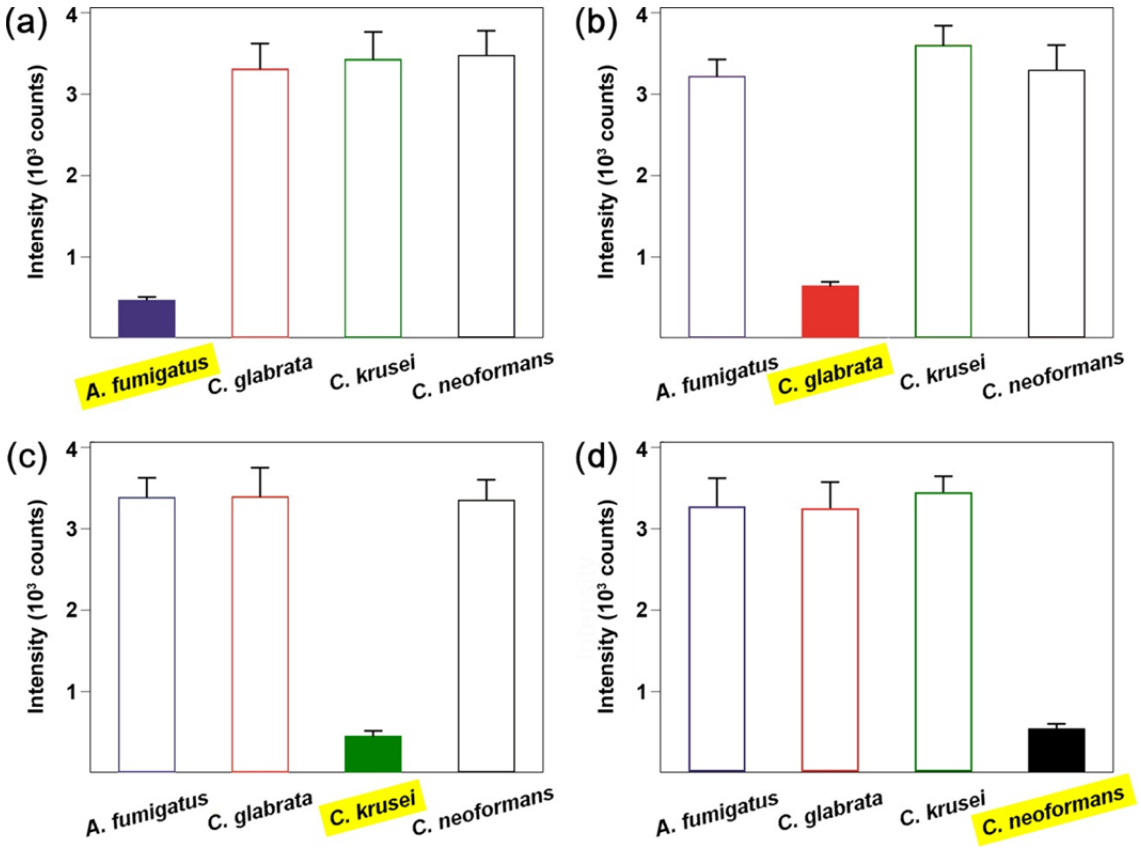

Figure S7. Color version of Figure 4. Identification of pathogenic fungal DNAs by patterned NW-on-film sensor coupled with target recycling reaction. The bars represent the SERRS intensities of 1580 cm^{-1} band obtained from each NW-on-film sensor. When the sample contains fungal target DNAs, only the corresponding capture DNAs-modified NW-on-film sensor shows decreased SERRS signals.