Electronic Supplementary Information

Repeatable and metal-independent nanotransfer printing based on metal oxidation for plasmonic color filters

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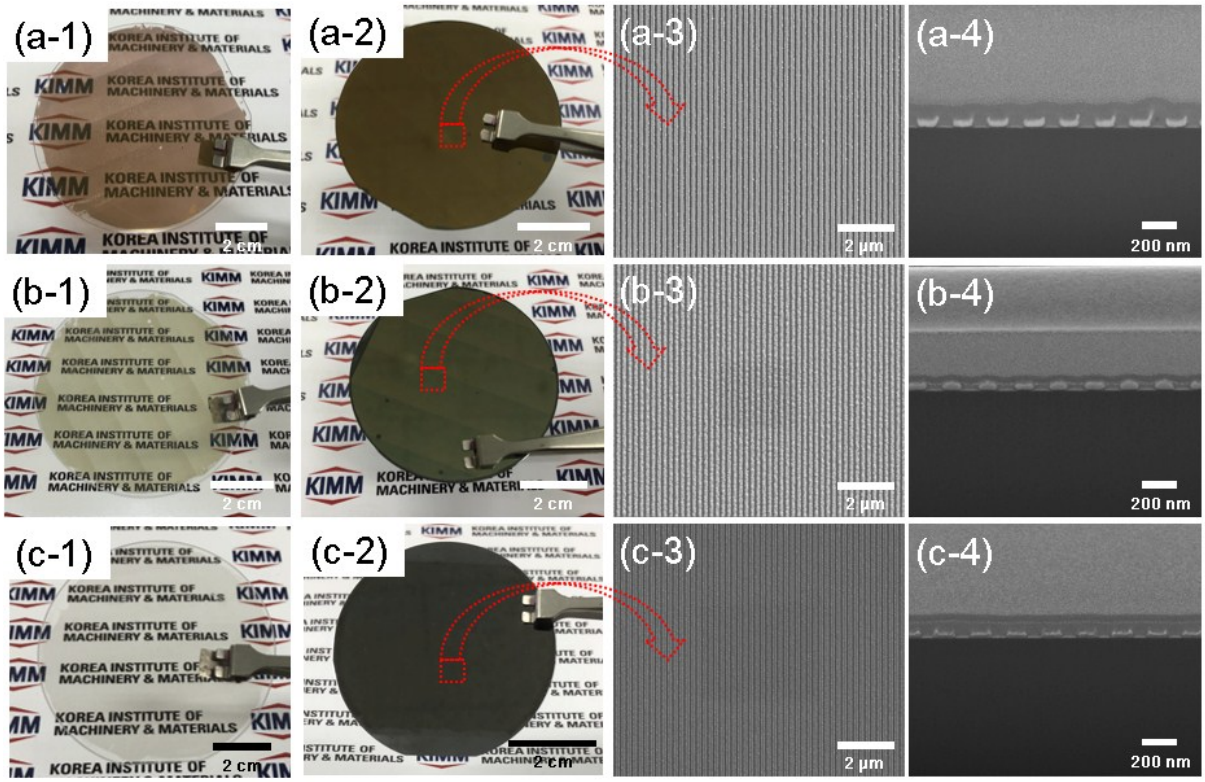


Fig. S1. (1) Photographs of metal-transferred glass and (2) Si substrates (2 inch diameter) and (3) surface and (4) cross-sectional FIB images of transferred 100 nm L/S nanopatterns of (a) Au, (b) Ag, and (b) Al.

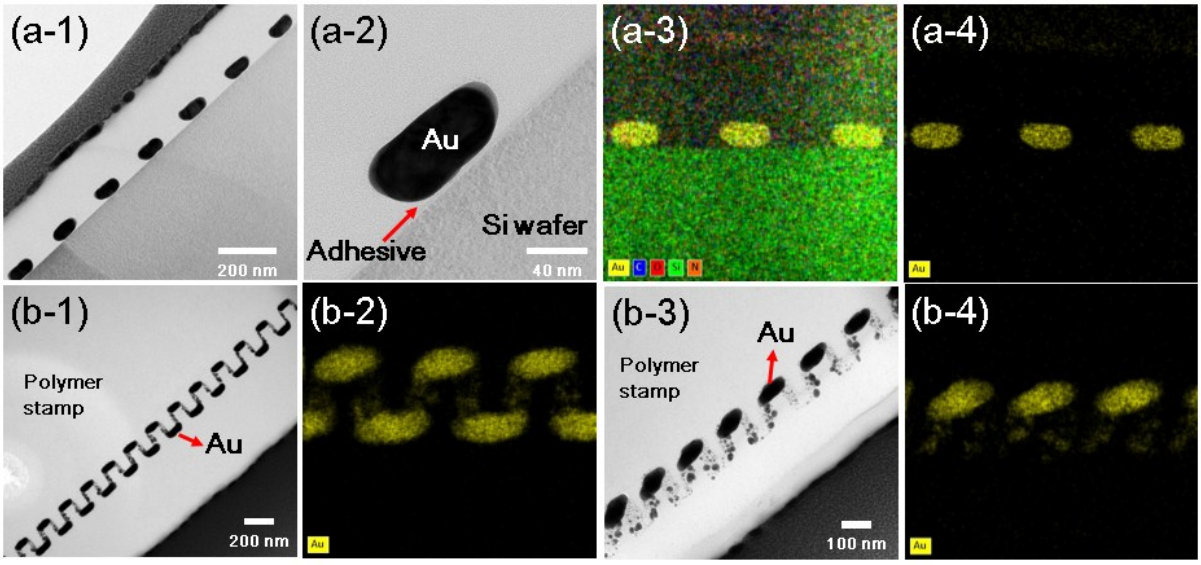


Fig. S2. TEM cross-sectional images and EDS maps before and after transfer of Au nanowires. (a-1,2) TEM images of the Au nanowires transferred onto a Si wafer at different magnifications. (a-3,4) EDS maps of transferred Au nanowires. (b-1,2) TEM image of the polymer stamp with deposited metals and EDS maps of Au before MiNP. (b-3,4) TEM image of the polymer stamp and EDS maps of Au after MiNP.

Fig. S3. Photograph of the mask used to deposit the metals on the polymer stamp at different angles.

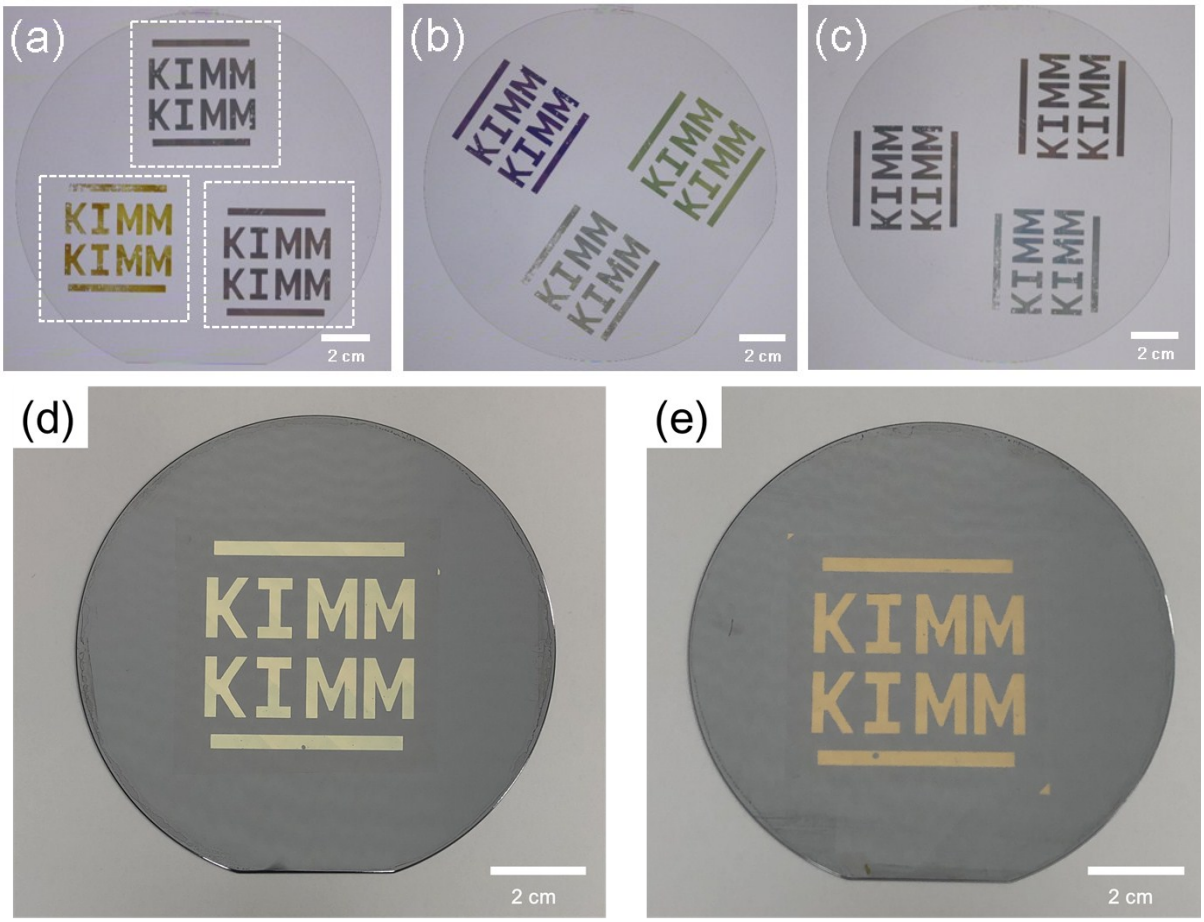


Fig. S4. Photographs of a 6 inch glass wafer with Au and Ag nanowires with different orientations repeatedly transferred to different areas of the same substrate. (a–c) Each geometrical figure shows a different color based on the materials and their orientation with respect to linearly polarized light. Photographs of a 4-inch Si wafer with (d) Ag and (e) Au nanowires transferred under the same conditions with different orientations, corresponding to Fig 2d-2 and Fig 2d-3, respectively, in the manuscript.

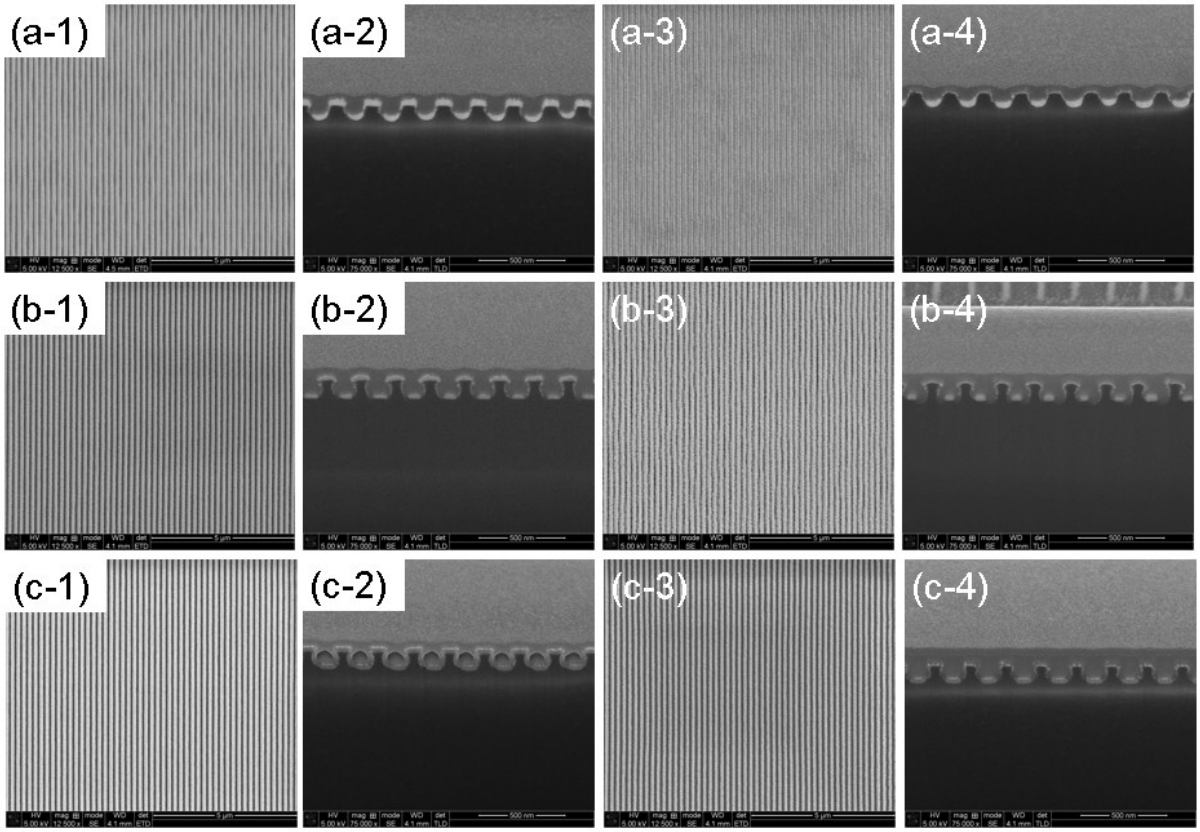


Fig. S5. FIB surface and cross-sectional images of polymer stamps with deposited metals. (1,2) Polymer stamps with metals and (3,4) polymer stamps after MiNP for (a) Au, (b) Ag, and (c) Al.

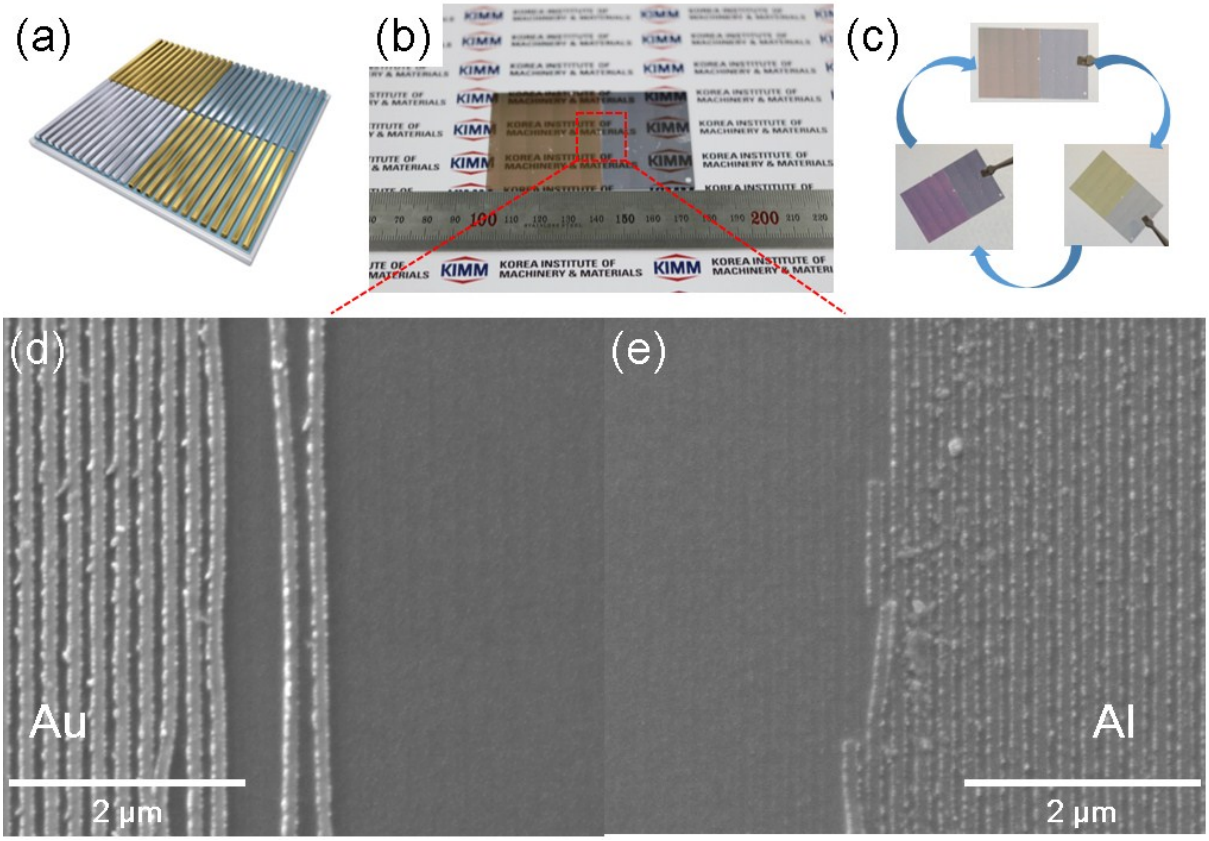


Fig. S6. Al and Au transferred onto a glass substrate using the stitch method. (a) Schematic diagram showing the color filter produced using the stitch method with patterns of different metals. Photographs of (b) the fabricated sample and (c) the sample showing different colors depending on the angle with respect to linearly polarized light. FIB surface image of transferred (d) Au and (e) Al nanowires.

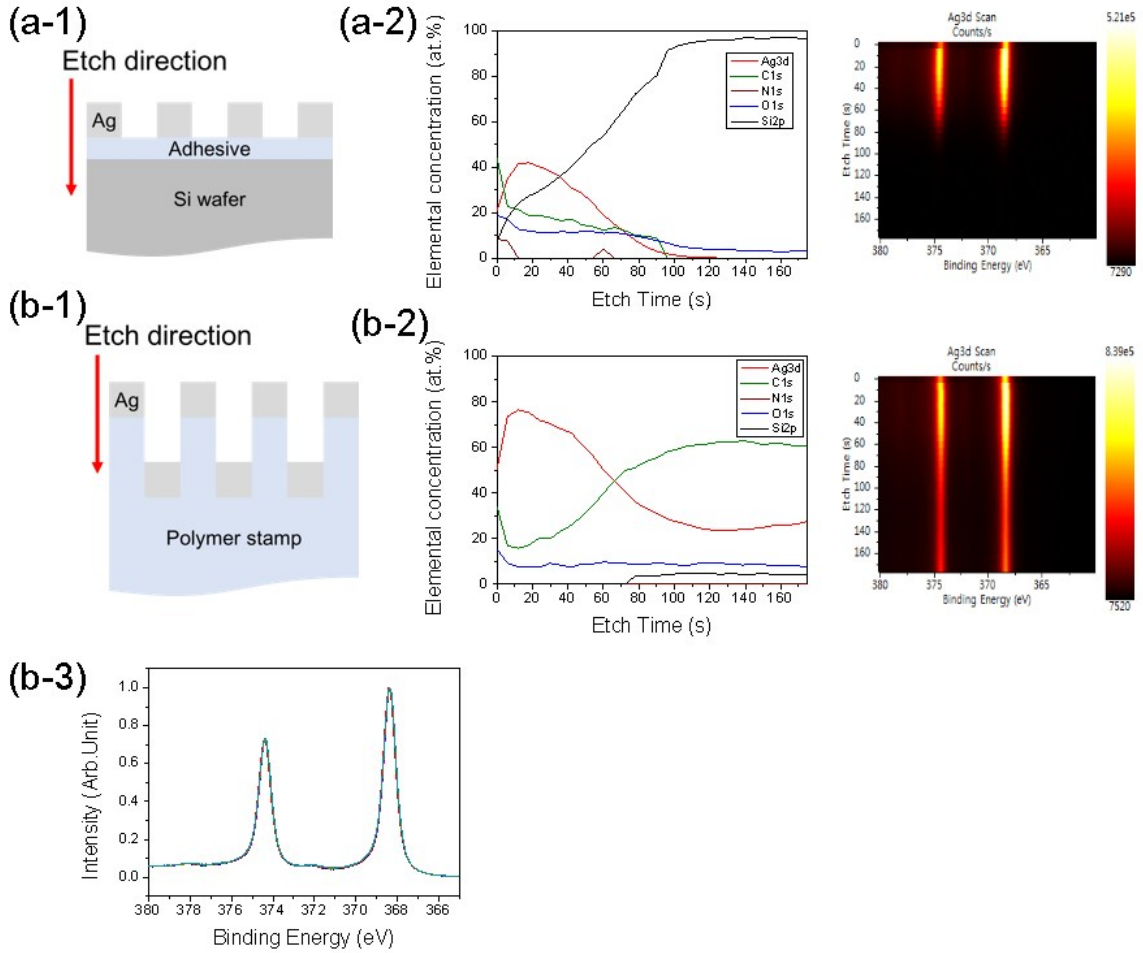


Fig. S7. XPS profiles showing the composition (at.%) of different elements as a function of etch time during etching the prepared sample with a Ag nanopattern. (a-1) Illustration showing the prepared sample and etch direction. (a-2) XPS elemental composition (at.%) after the Ag nanowires were transferred to the Si substrate and the Ag3d binding energy intensity map as a function of etch time. (b-1) Illustration showing the Ag-deposited polymer stamp. (b-2) XPS elemental composition of Ag on the polymer stamp and the Ag3d binding energy intensity map as a function of etch time. (b-3) Normalized Ag binding energy as a function of etch time.

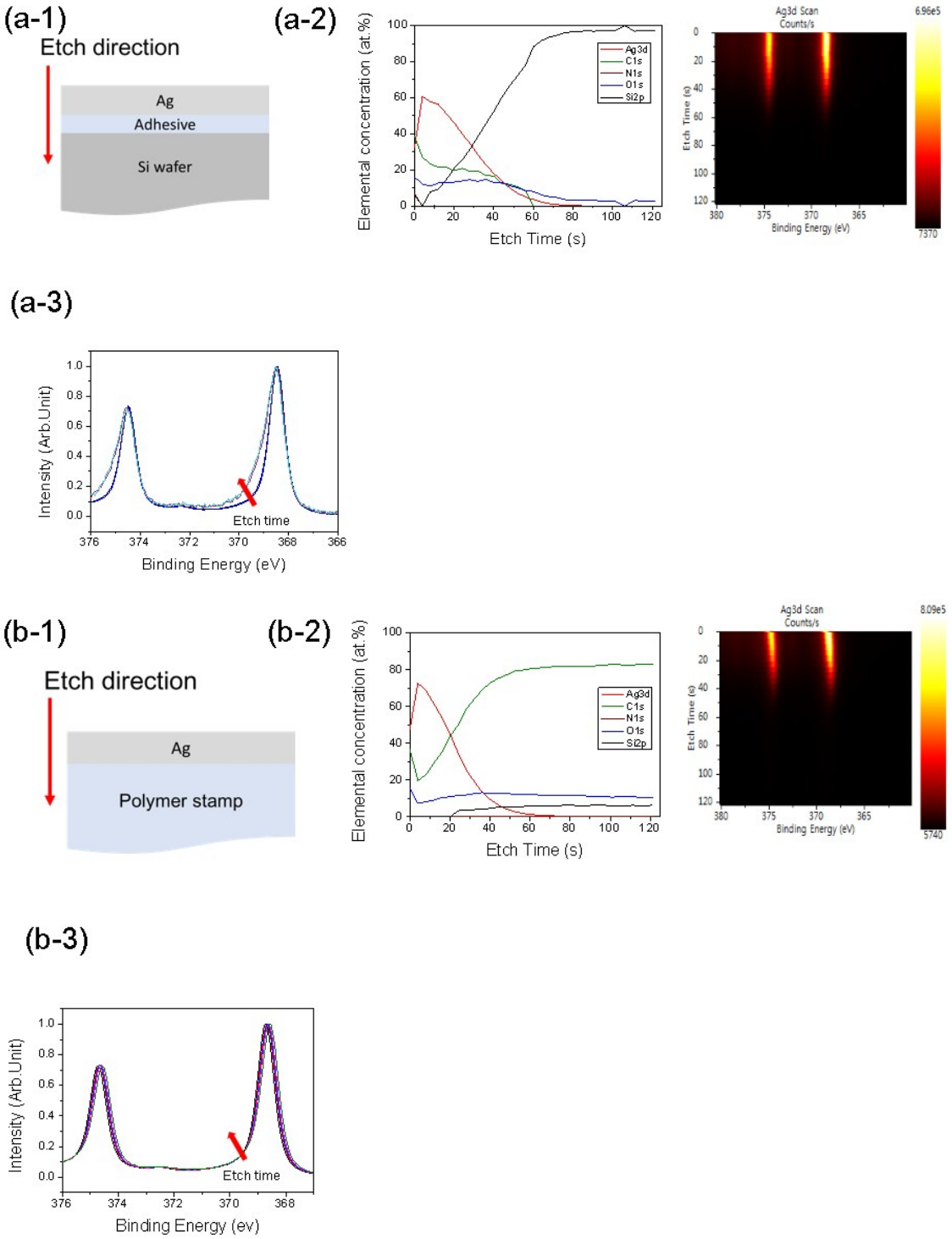


Fig. S8. XPS elemental composition (at.%) as a function of etch time for the sample with the Ag thin film. (a-1) Illustration of the prepared sample and etch direction. (a-2) XPS elemental composition (at.%) after the Ag thin film was transferred to the Si substrate and the Ag3d binding energy intensity map as a function of etch time. (a-3) Normalized Ag3d binding energy peaks as a function of etch time. (b-1) Ag-deposited polymer stamp. (b-2) XPS elemental composition (at.%) of the polymer stamp and the Ag3d binding energy intensity map with respect to etch time. (b-3) Normalized Ag3d binding energy peaks as a function of etch time.

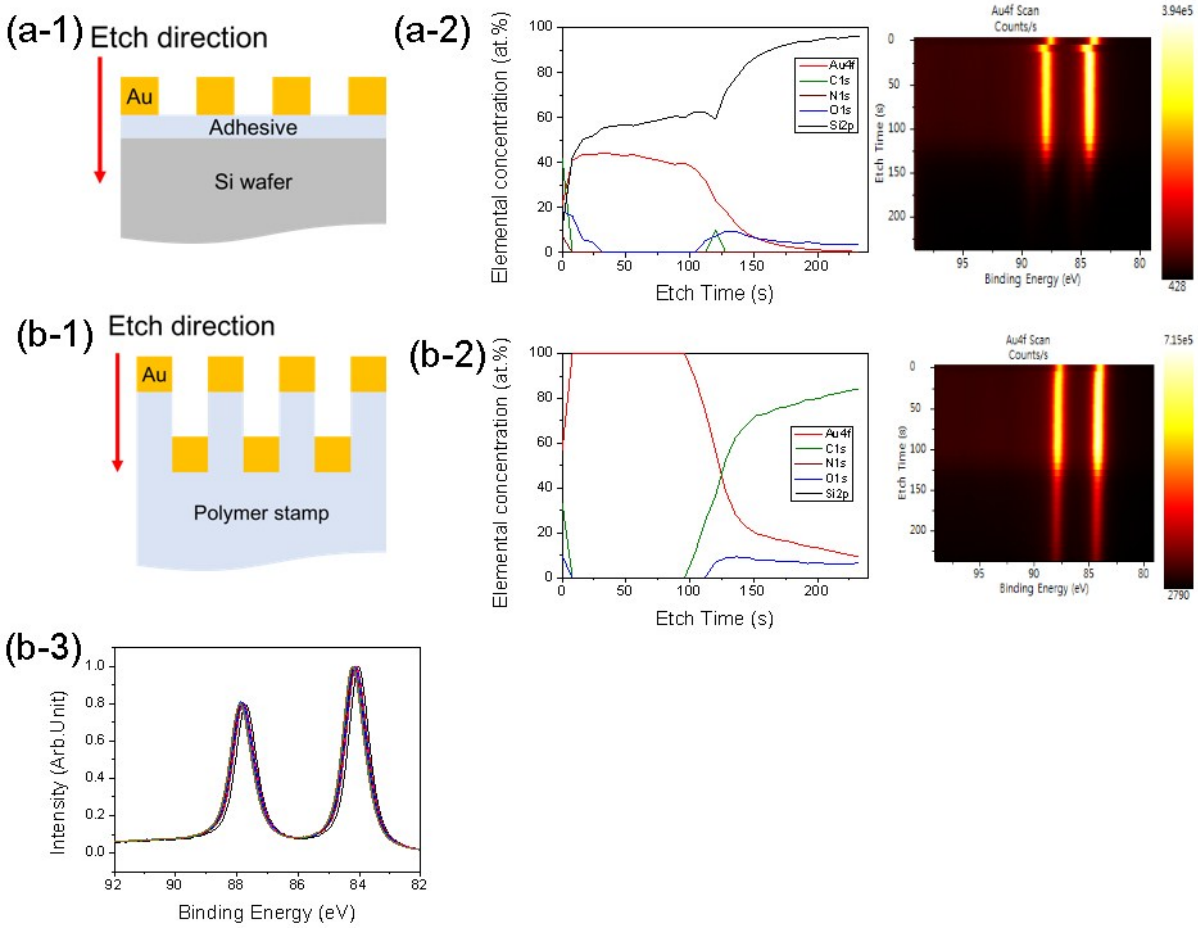


Fig. S9. XPS profiles showing the composition (at.%) of different elements as a function of etch time during etching the prepared sample with a Au nanopattern. (a-1) Illustration showing the prepared sample and etch direction. (a-2) Composition (at.%) XPS profiles after the Au nanowires were transferred to the Si substrate and the Au4f binding energy intensity map with respect to etch time. (b-1) Au-deposited polymer stamp. (b-2) Composition (at.%) XPS profiles of elements on the polymer stamp and the Au4f binding energy intensity map with respect to etch time. (b-3) Normalized Au binding energy peaks as a function of etch time.

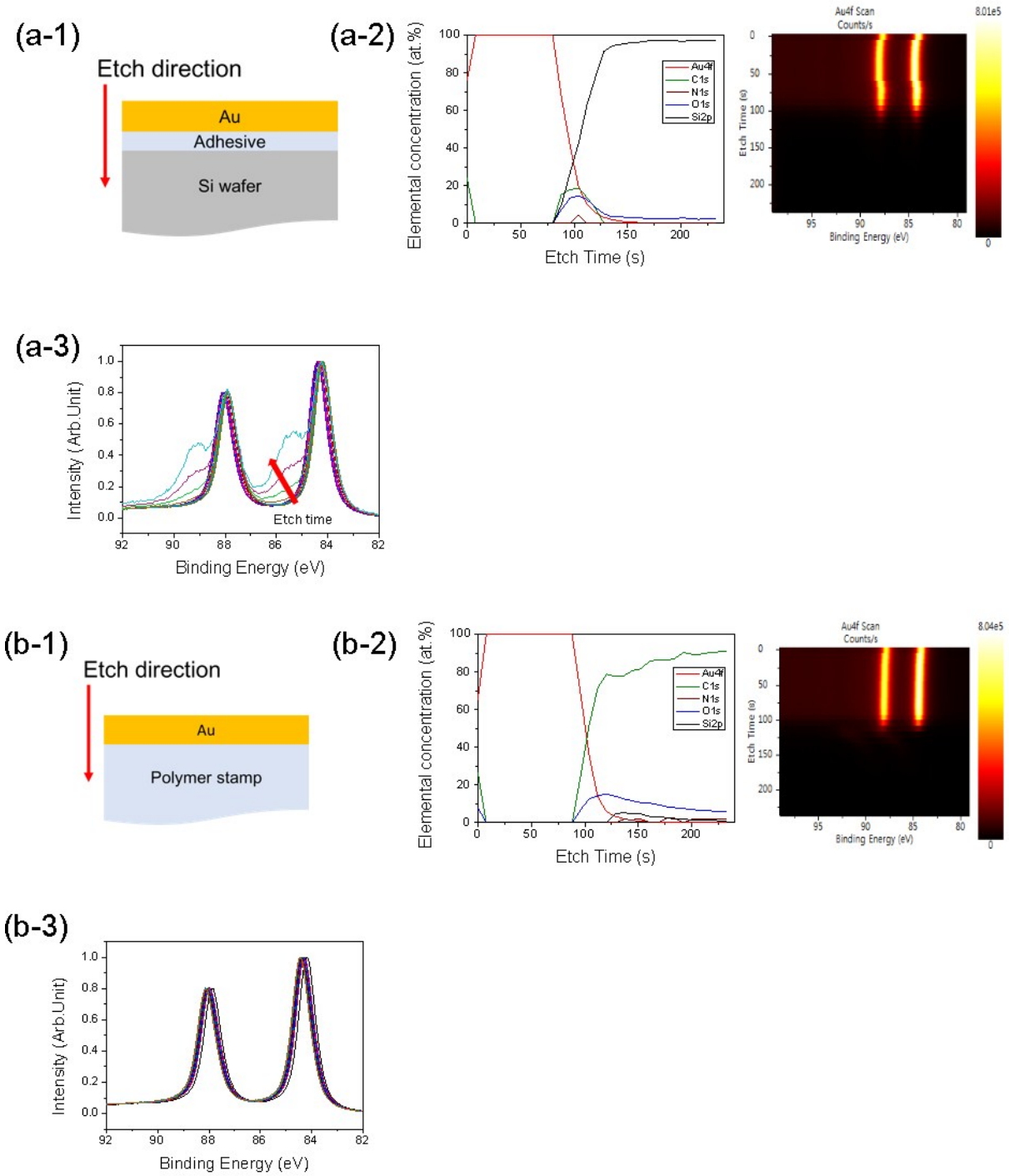


Fig. S10. XPS profiles showing the composition (at.%) of different elements as a function of etch time during etching the prepared sample with a Au thin film. (a-1) Illustration of the prepared sample and etch direction. (a-2) Composition (at.%) XPS profile after the Au thin film was transferred to the Si substrate and the Au4f binding energy intensity map with respect to etch time. (a-3) Normalized Au4f binding energy peaks as a function of etch time. (b-1) Au-deposited polymer stamp. (b-2) Composition (at.%) XPS profile of elements on the polymer stamp and the Au4f binding energy intensity map with respect to etch time. (b-3) Normalized Au4f binding energy peaks as a function of etch time.

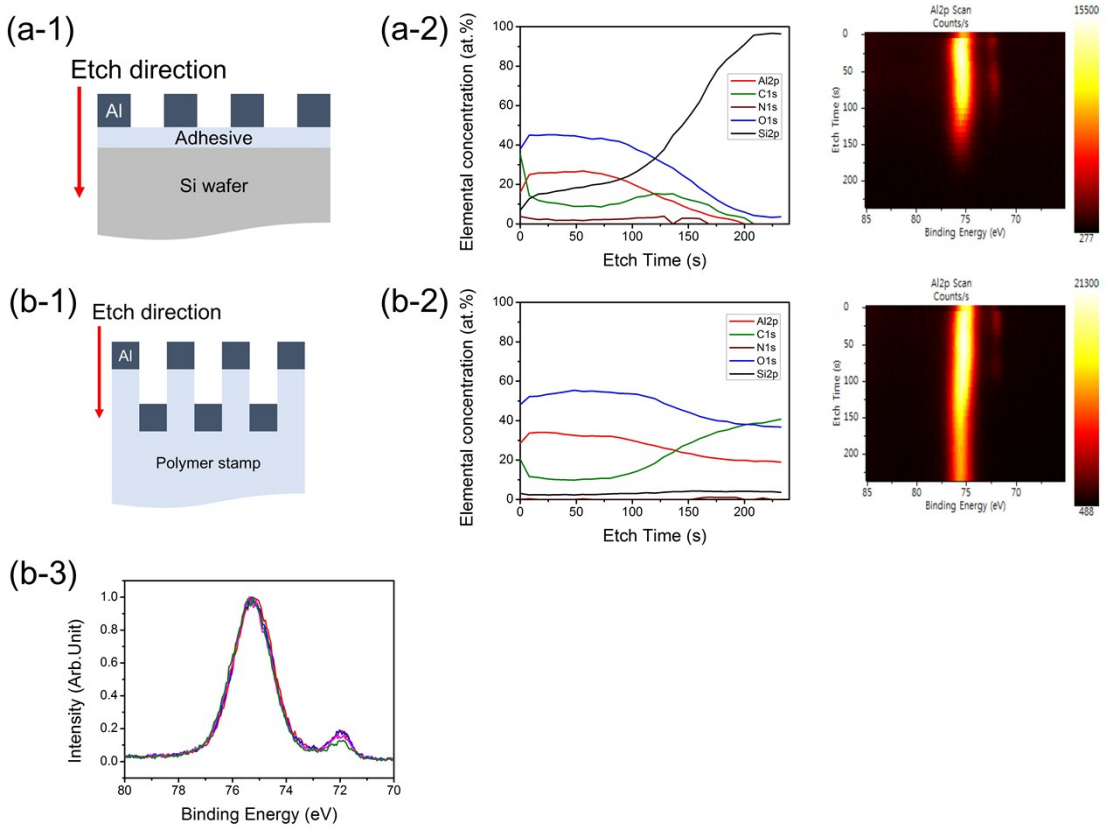


Fig. S11. XPS profiles showing the composition (at.%) of different elements as a function of etch time during etching the prepared sample with an Al nanopattern. (a-1) Illustration of the prepared sample and etch direction. (a-2) Composition (at.%) XPS profile after the Al nanowires were transferred to the Si substrate and the Al2p binding energy intensity map with respect to etch time. (b-1) Al-deposited polymer stamp. (b-2) Composition (at.%) XPS profile of elements on the polymer stamp and the Al2p binding energy intensity map with respect to etch time. (b-3) Normalized Al binding energy peaks as a function of etch time

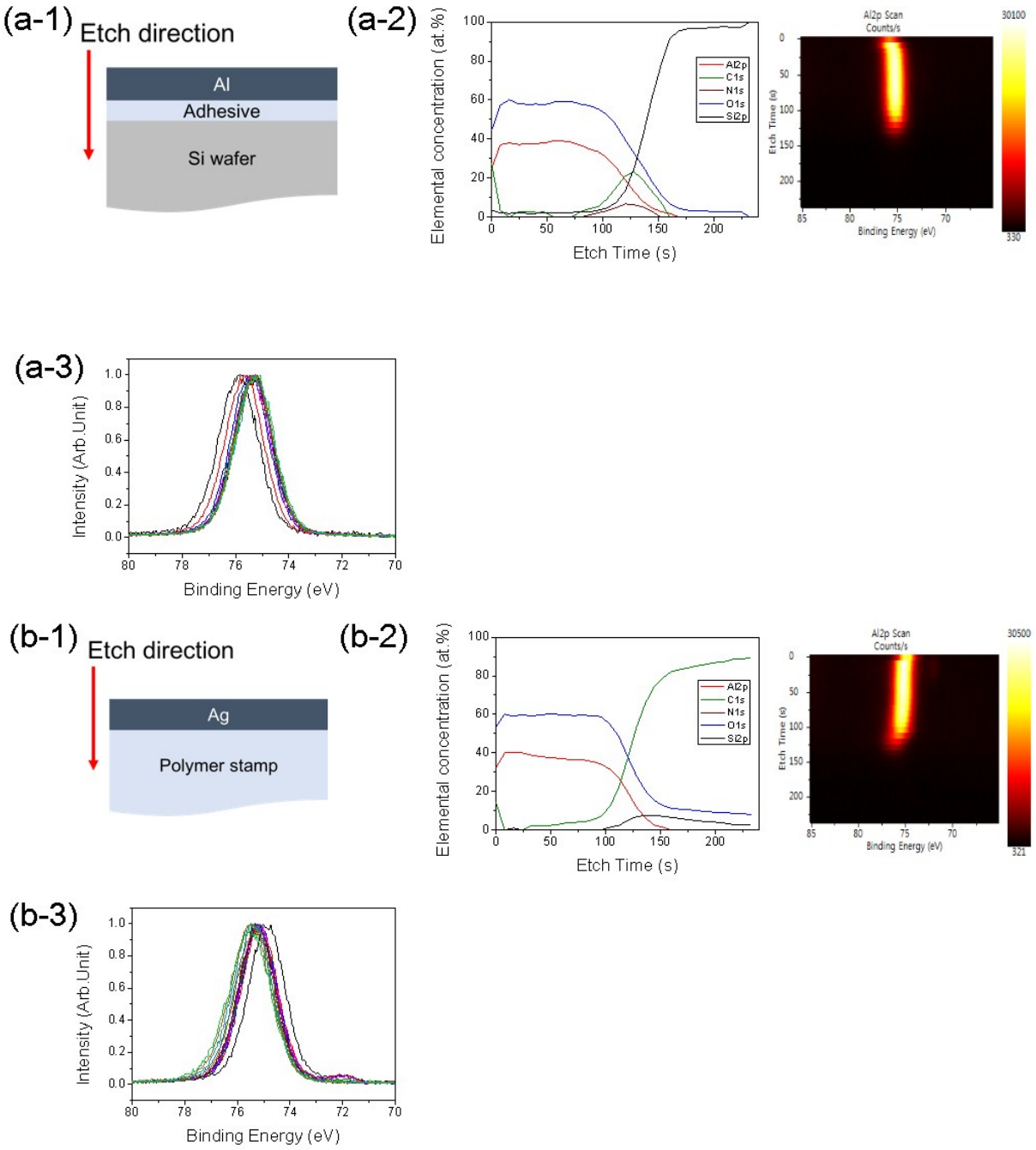
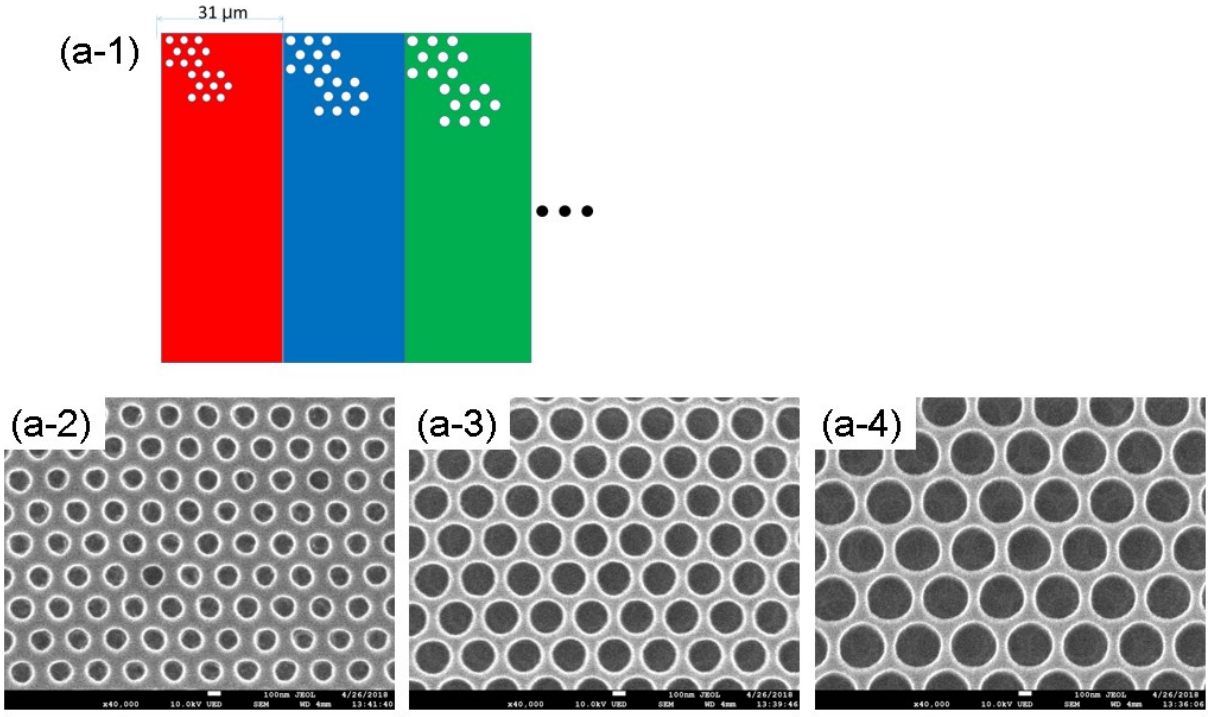


Fig. S12. XPS profiles showing the composition (at.%) of different elements as a function of etch time during etching the prepared sample with an Al thin film. (a-1) Illustration of the prepared sample and etch direction. (a-2) Composition (at.%) XPS profile after the Al thin film was transferred to the Si substrate and the Al2p binding energy intensity map with respect to etch time. (a-3) Normalized Al2p binding energy peaks as a function of etch time. (b-1) Al-deposited polymer stamp. (b-2) Composition (at.%) XPS profile of elements on the polymer stamp and the Al2p binding energy intensity map with respect to etch time. (b-3) Normalized Al2p binding energy peaks as a function of etch time.



Period	280 nm
Diameter	150 nm

Period	340 nm
Diameter	240 nm

Period	420 nm
Diameter	320 nm

Fig. S13. (a-1) Conceptual image of the color filter design composed of 31 μm pixels for red, blue, and green. SEM surface images of the replicated polymer stamp showing the different periods and diameters corresponding to (a-2) red, (a-3) blue, and (a-4) green.

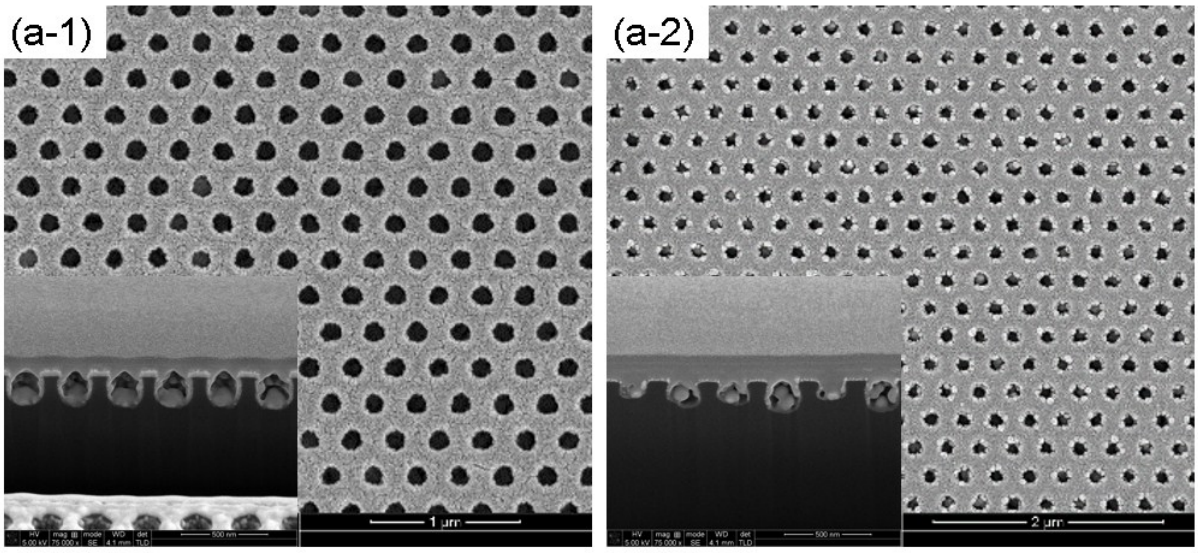


Fig. S14. Surface and (inset) cross-sectional FIB images of the nanohole array used for preparing the color filter (a-1) before and (a-2) after MiNP.

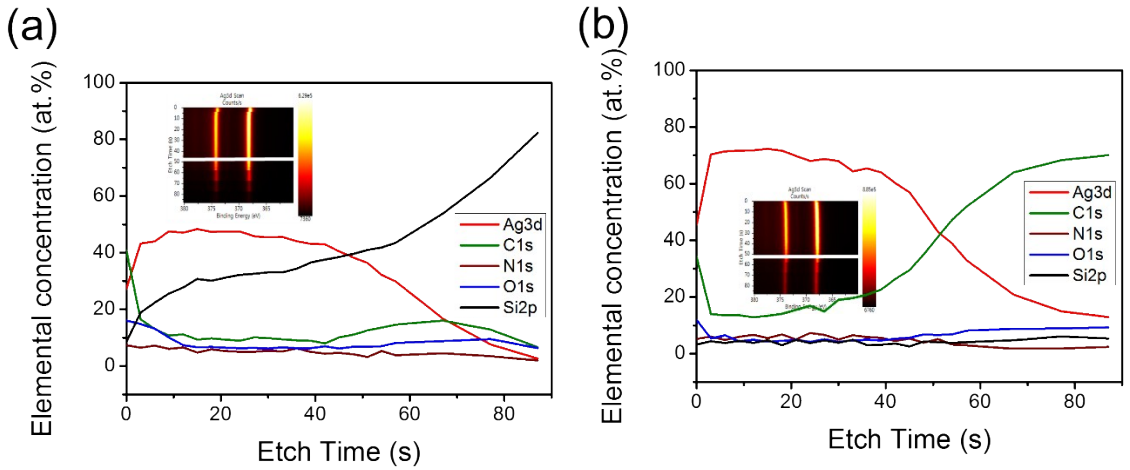


Fig. S15. XPS profiles of the nanohole array showing the composition of different elements (at.%) as a function of etch time (a-1) after and (a-2) before Ag was transferred.

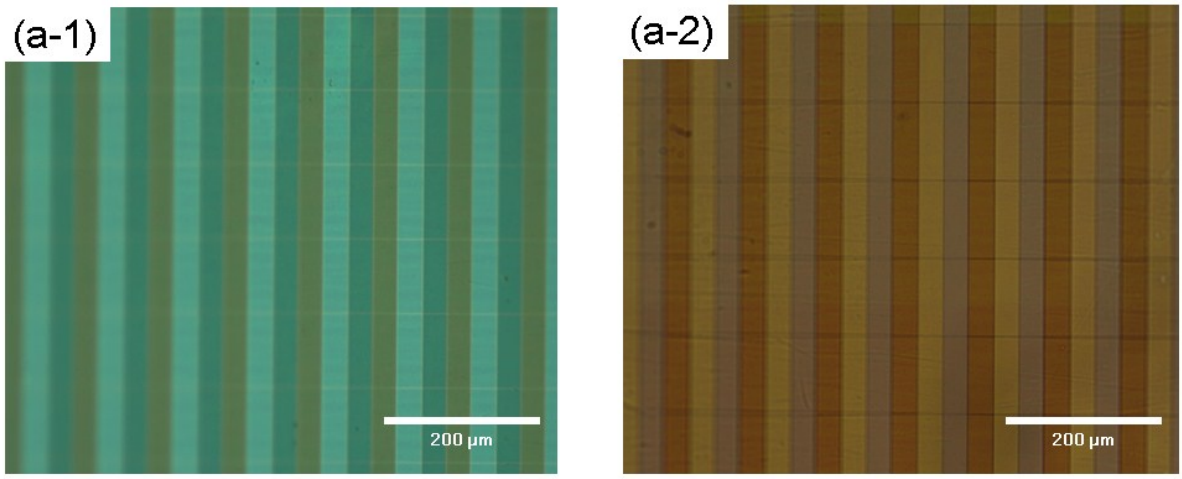


Fig. S16. Optical microscopy images obtained from the color filter fabricated on the curved glass substrate in (a-1) reflectance and (a-2) transmittance modes.

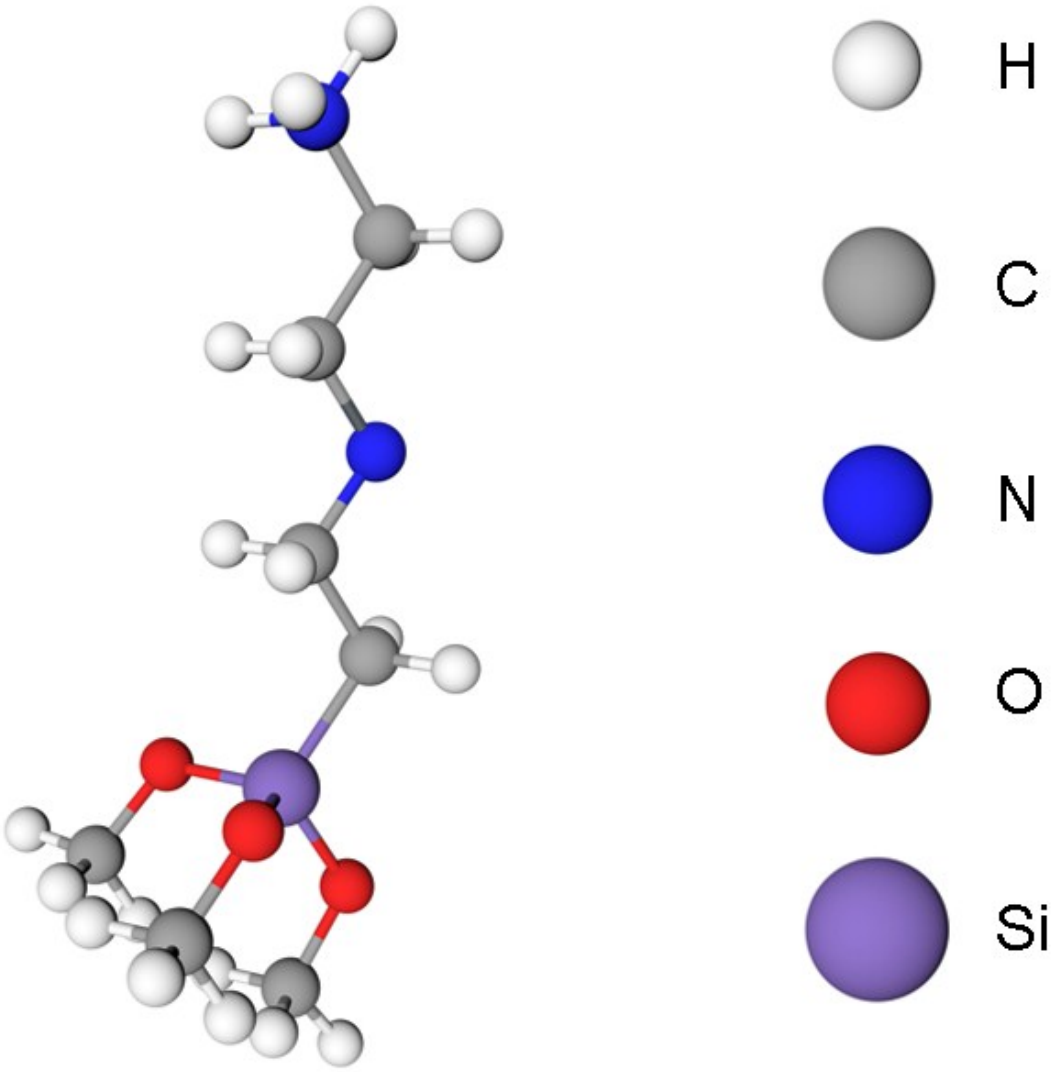


Fig. S17. Schematic illustration of the adhesive material used in the MiNP method.