

Supporting Information

Investigation into the reactivity of unsupported and supported Ag₇ and Ag₈ clusters with toxic metal ions

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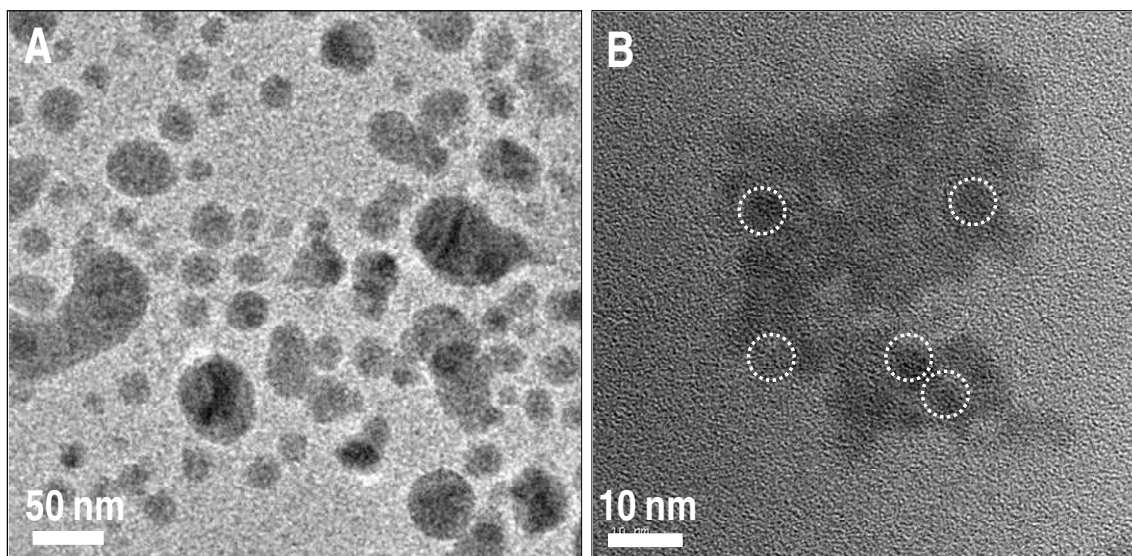


Figure S1. TEM images of Ag@MSA nanoparticles (A) and Ag_{7,8}(MSA)_{7,8} quantum clusters (B). After electron beam irradiation nanoparticles are intact whereas silver clusters are aggregated due to their sensitivity to electron beam. In B some of the aggregated clusters are shown using dotted circles.

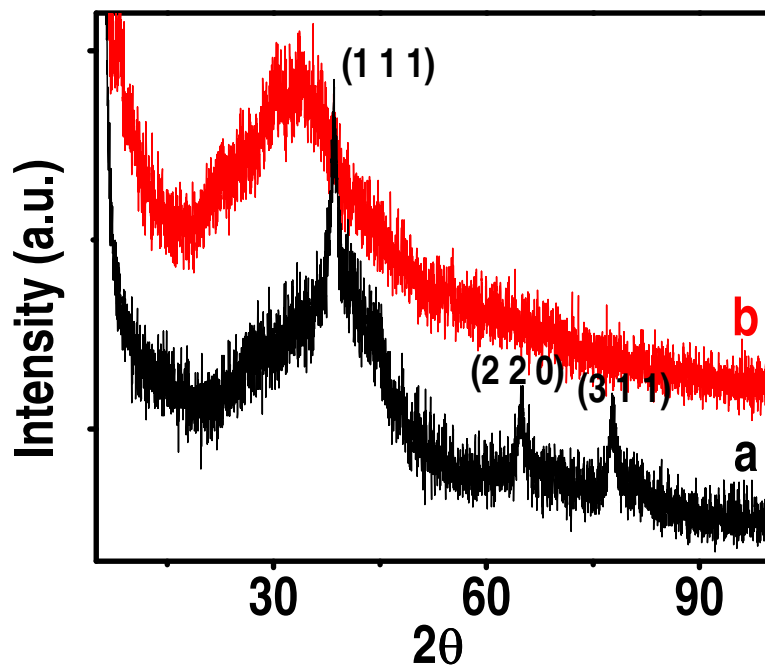


Figure S2. XRD patterns of Ag@MSA nanoparticles (a) and Ag_{7,8}(MSA)_{7,8} quantum clusters (b).

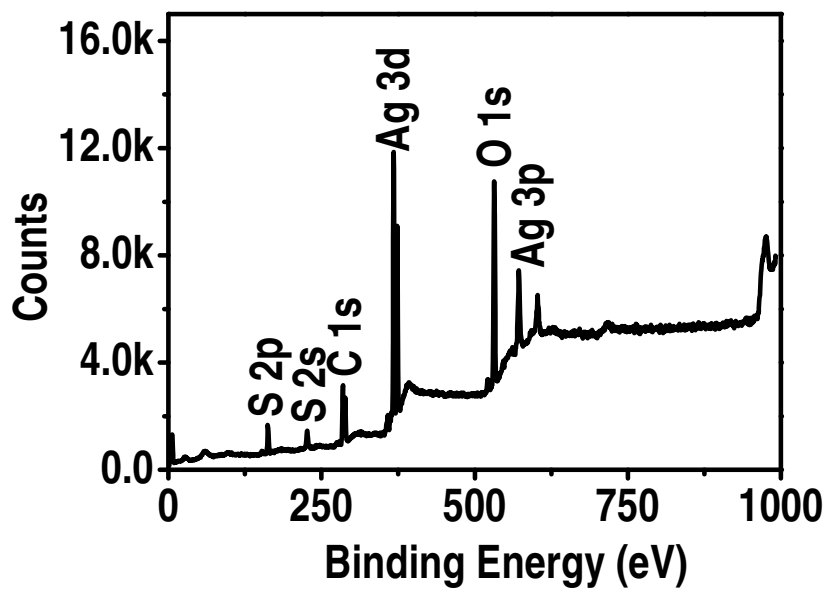


Figure S3. XPS survey spectrum of Ag(I)MSA thiolate.

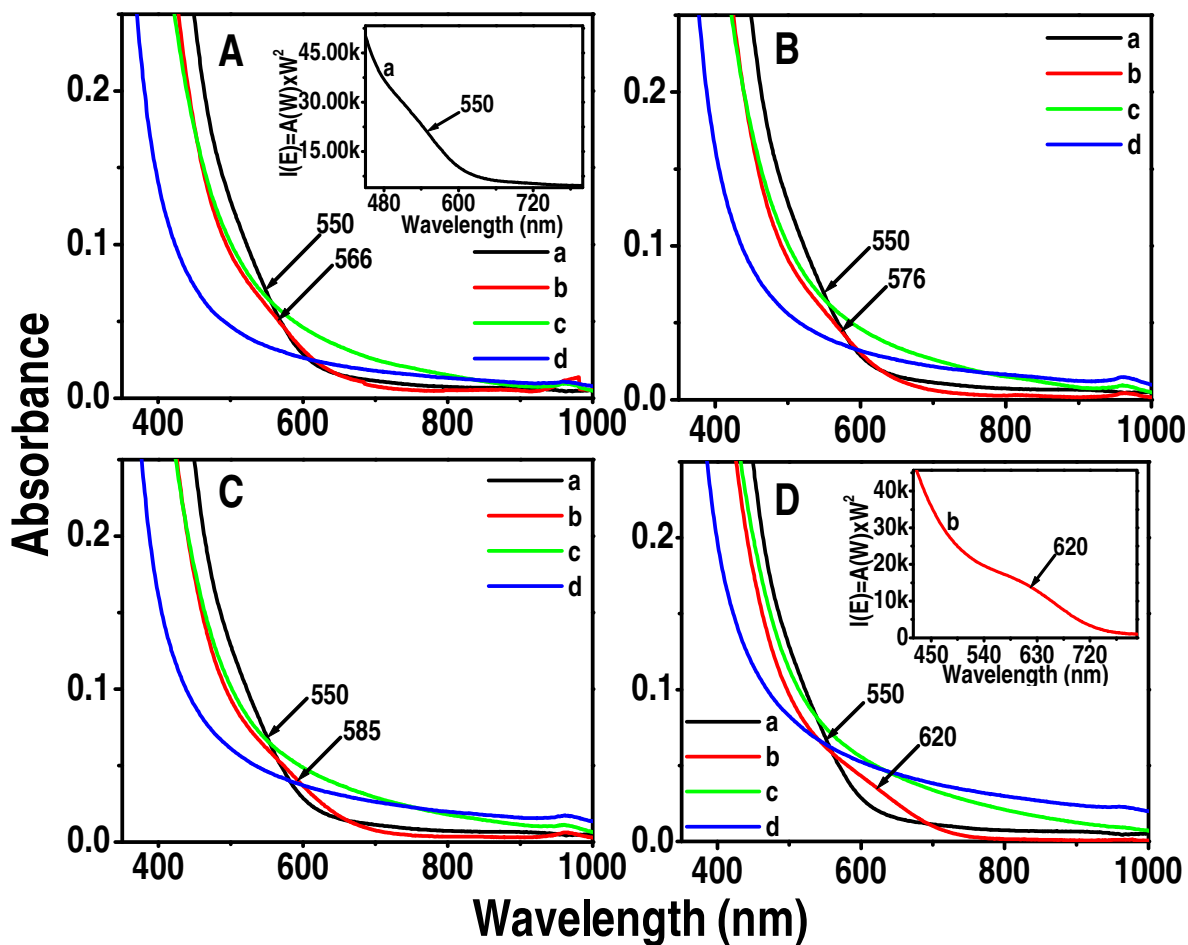


Figure S4. UV-vis absorption profiles of $\text{Ag}_{7.8}(\text{MSA})_{7.8}$ clusters after 5 minutes (A), 30 minutes (B), 6 hours (C) and 24 hours (D) which are treated with 10, 50 and 100 ppm $\text{Hg}(\text{II})$ solutions (traces b, c and d, respectively). Absorption spectra of parent cluster (trace a) and 10 ppm Hg^{2+} treated cluster (after 24 h) are shown as insets of A and D, respectively for clarity.

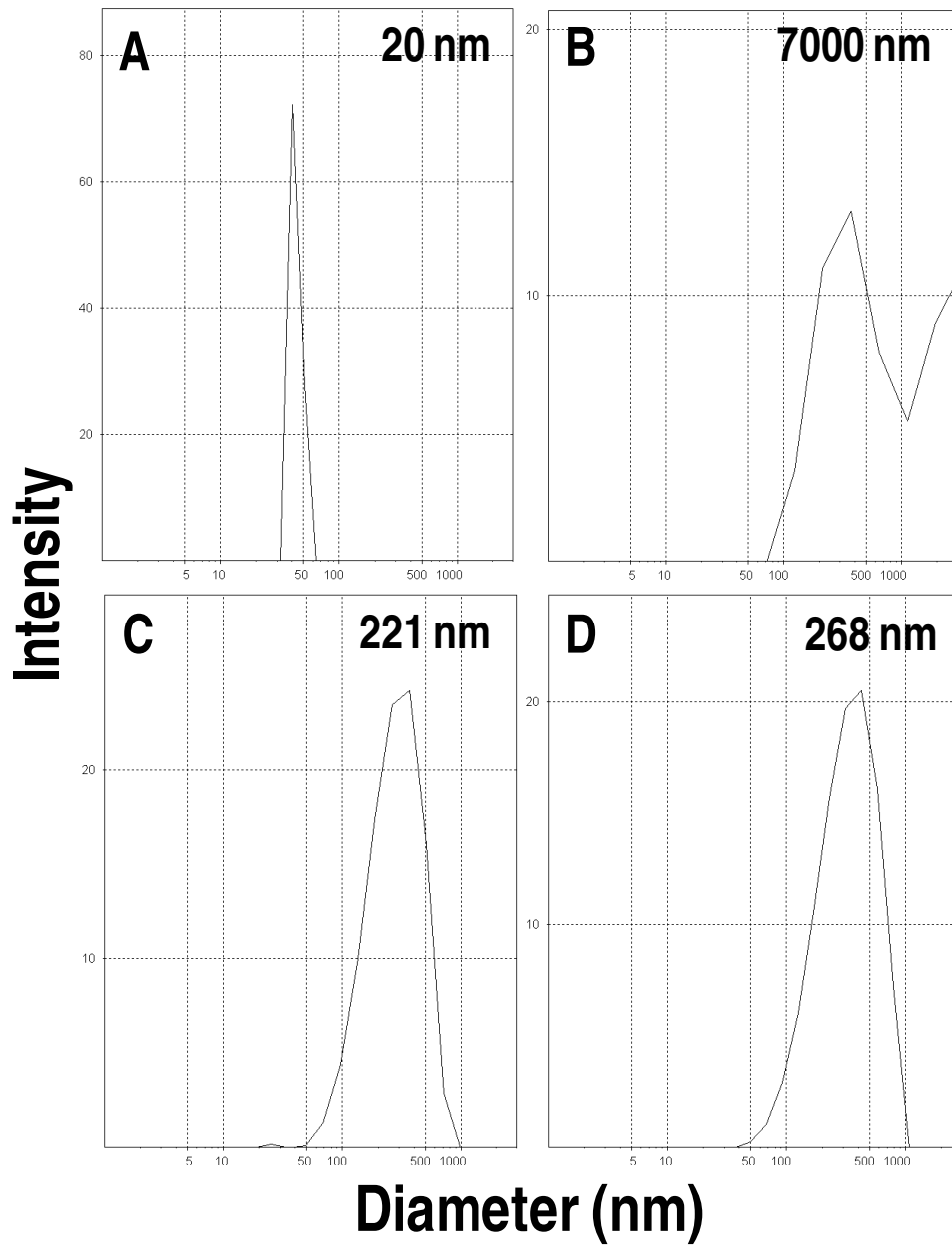


Figure S5. DLS plots of $\text{Ag}_{7,8}(\text{MSA})_{7,8}$ clusters treated with 10, 50 and 100 ppm $\text{Hg}(\text{II})$ solutions (B, C and D, respectively) after 24 hours. Plot A corresponds to parent $\text{Ag}_{7,8}(\text{MSA})_{7,8}$ clusters.

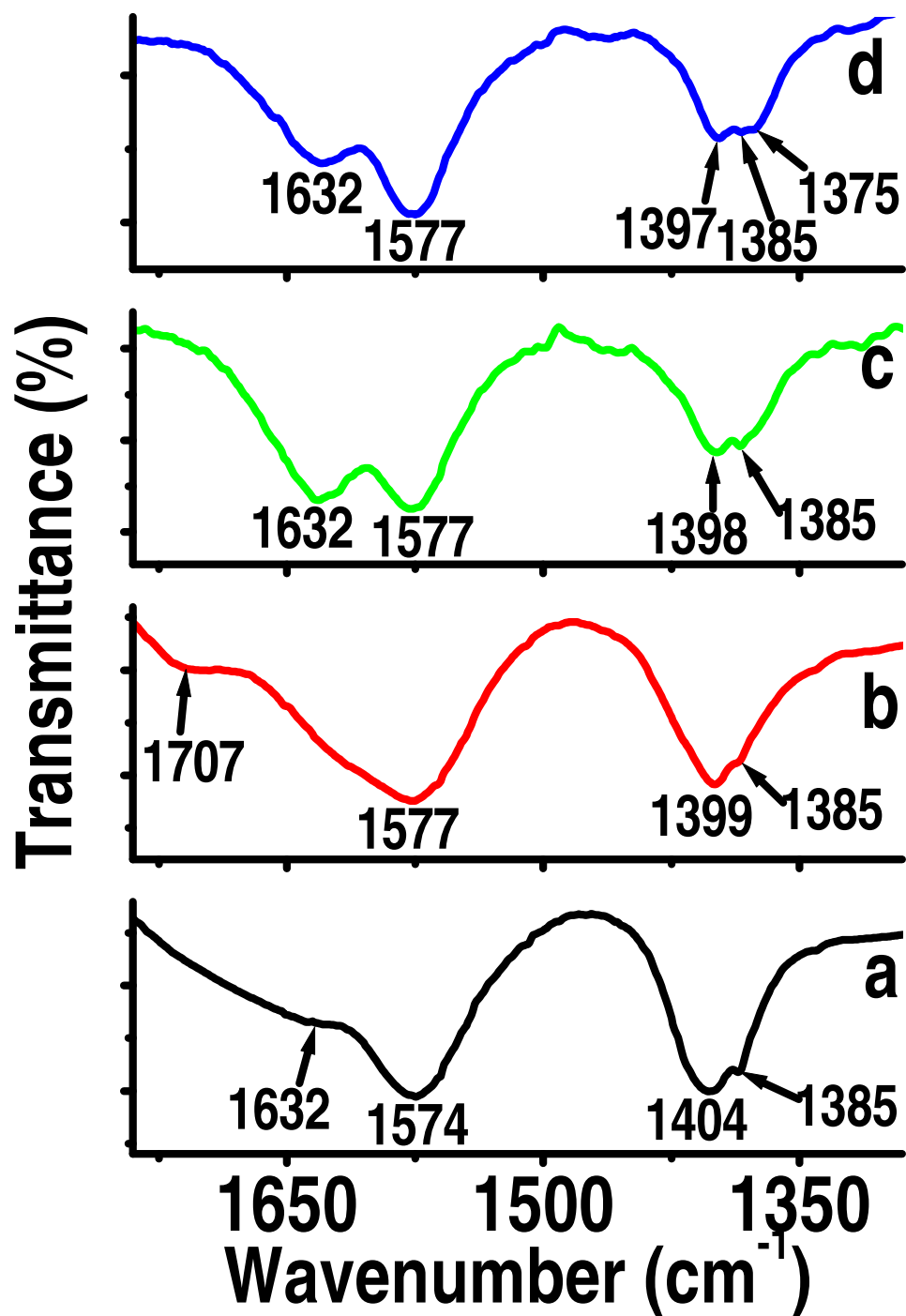


Figure S6. FTIR spectra of $\text{Ag}_{7,8}(\text{MSA})_{7,8}$ clusters treated with 10, 50 and 100 ppm $\text{Hg}(\text{II})$ solutions (traces b, c and d, respectively). Trace a corresponds to parent cluster (shown for comparison).

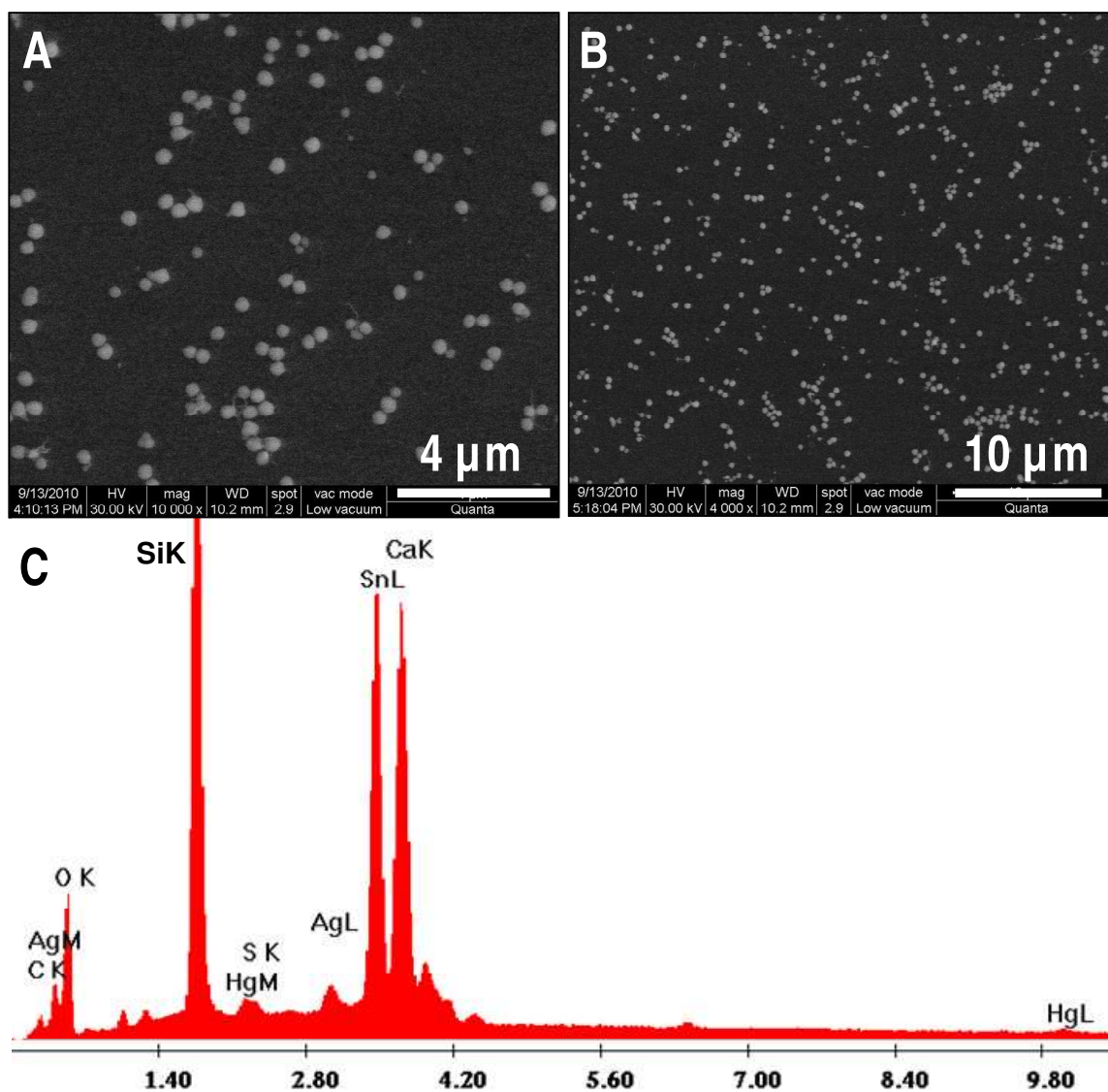


Figure S7. SEM images (A and B) of $Ag_{7,8}(MSA)_{7,8}$ clusters treated with 100 ppm Hg(II) solution (after 24 hours). C is the EDAX spectrum of the same sample. Si and Sn are due to the substrate used.

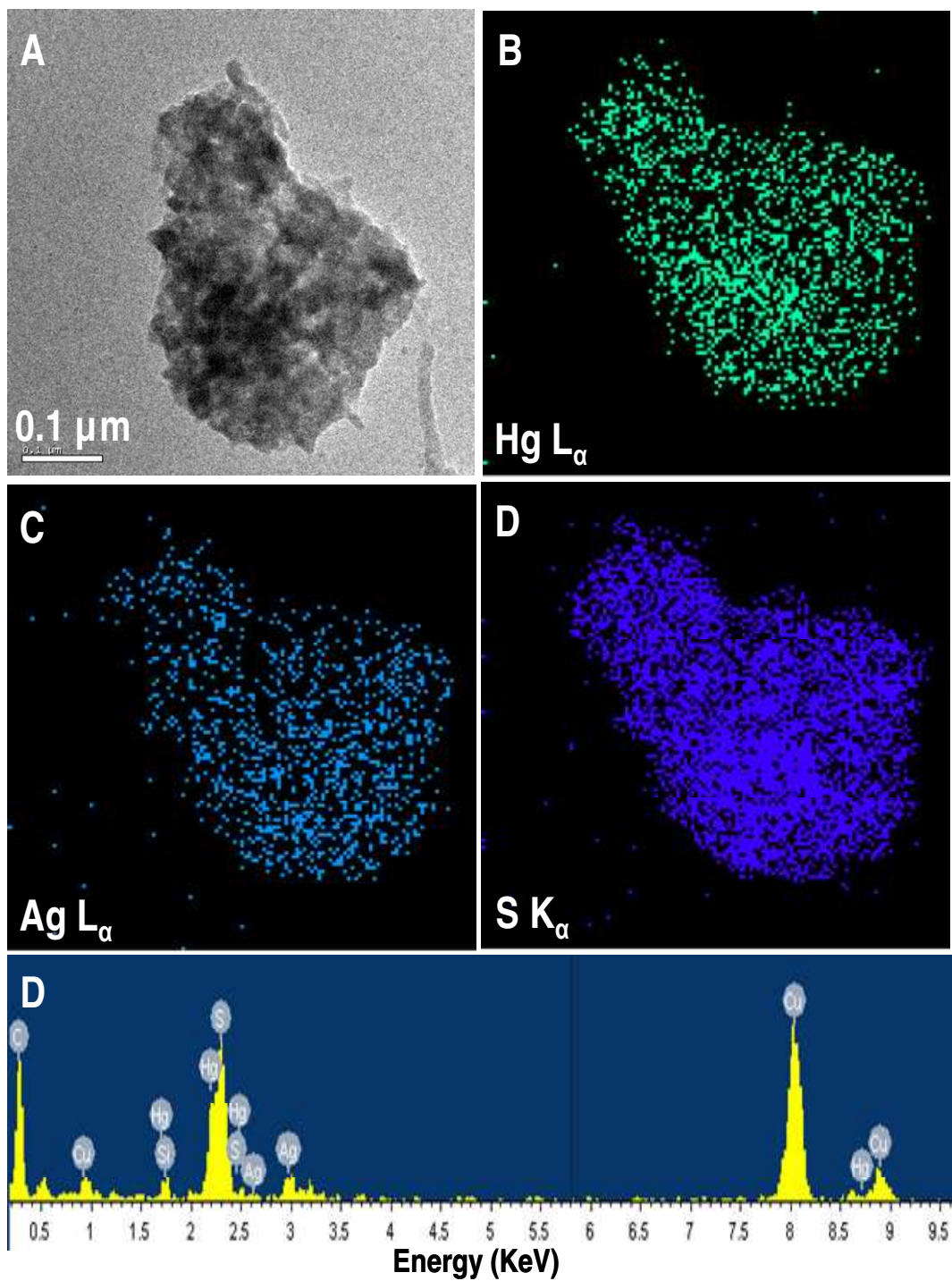


Figure S8. TEM image (A) and elemental maps of Hg, Ag and S (B, C and D, respectively) of $\text{Ag}_{7.8}(\text{MSA})_{7.8}$ clusters treated with 100 ppm Hg(II) solution (after 24 hours). D is the TEM-EDAX spectrum of the same sample. Cu is due to the grid used.

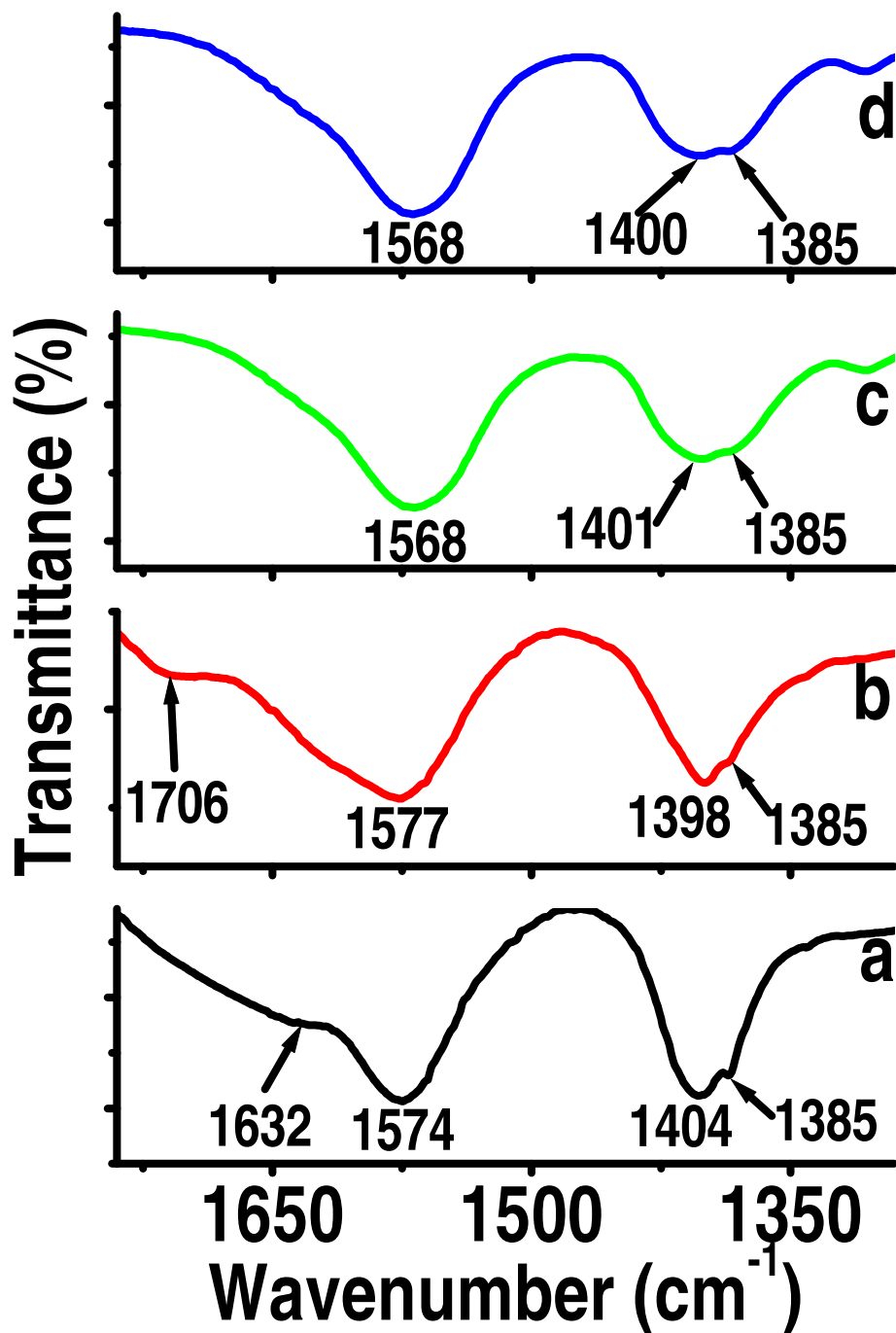


Figure S9. FTIR spectra of $\text{Ag}_{7,8}(\text{MSA})_{7,8}$ clusters treated with 10, 50 and 100 ppm $\text{Cd}(\text{II})$ solutions (traces b, c and d, respectively). Trace a corresponds to parent silver quantum cluster (shown for comparison).

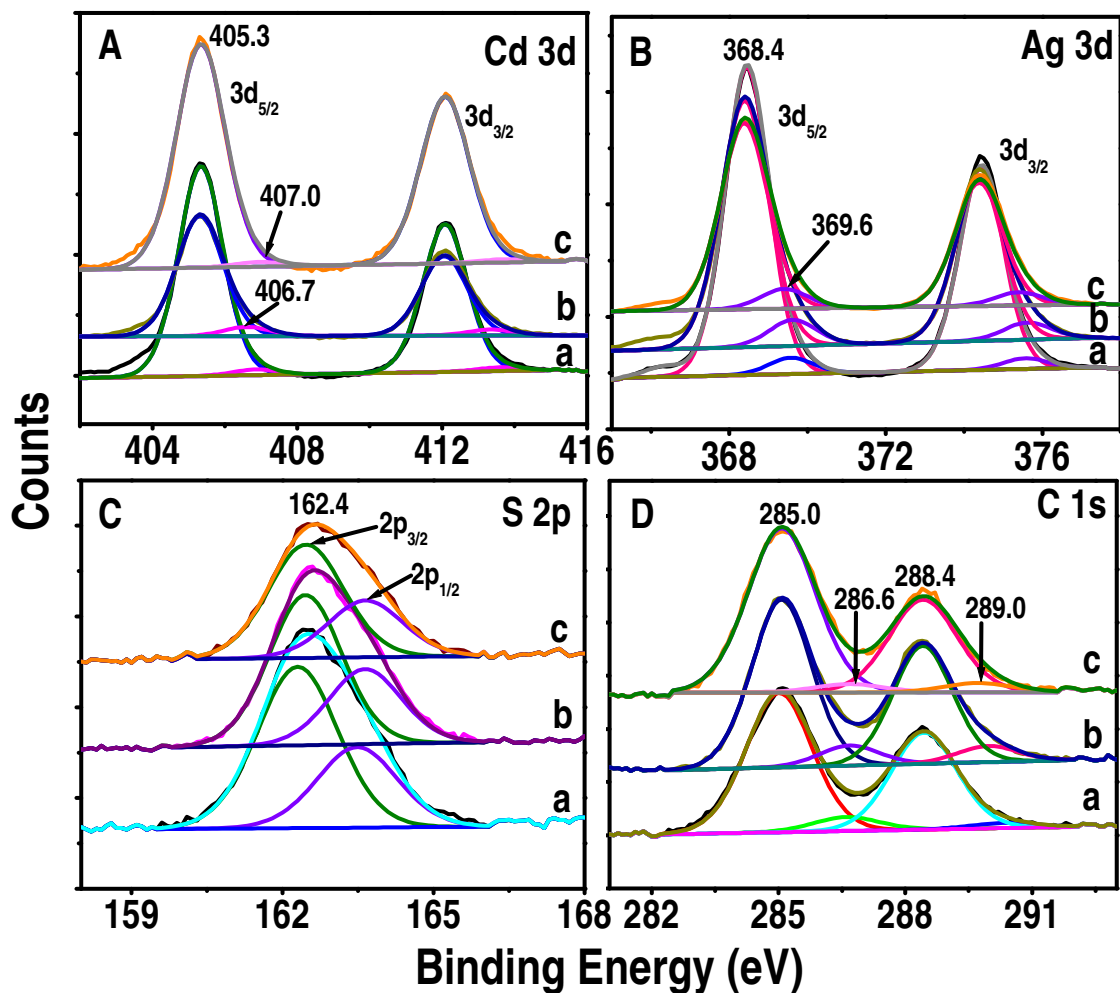


Figure S10. X-ray photoelectron spectra of $\text{Ag}_{7,8}(\text{MSA})_{7,8}$ clusters treated with 10, 50 and 100 ppm $\text{Cd}(\text{II})$ solutions (traces a, b and c, respectively). Cd 3d, Ag 3d, S 2p and C 1s regions are shown in A, B, C and D, respectively.

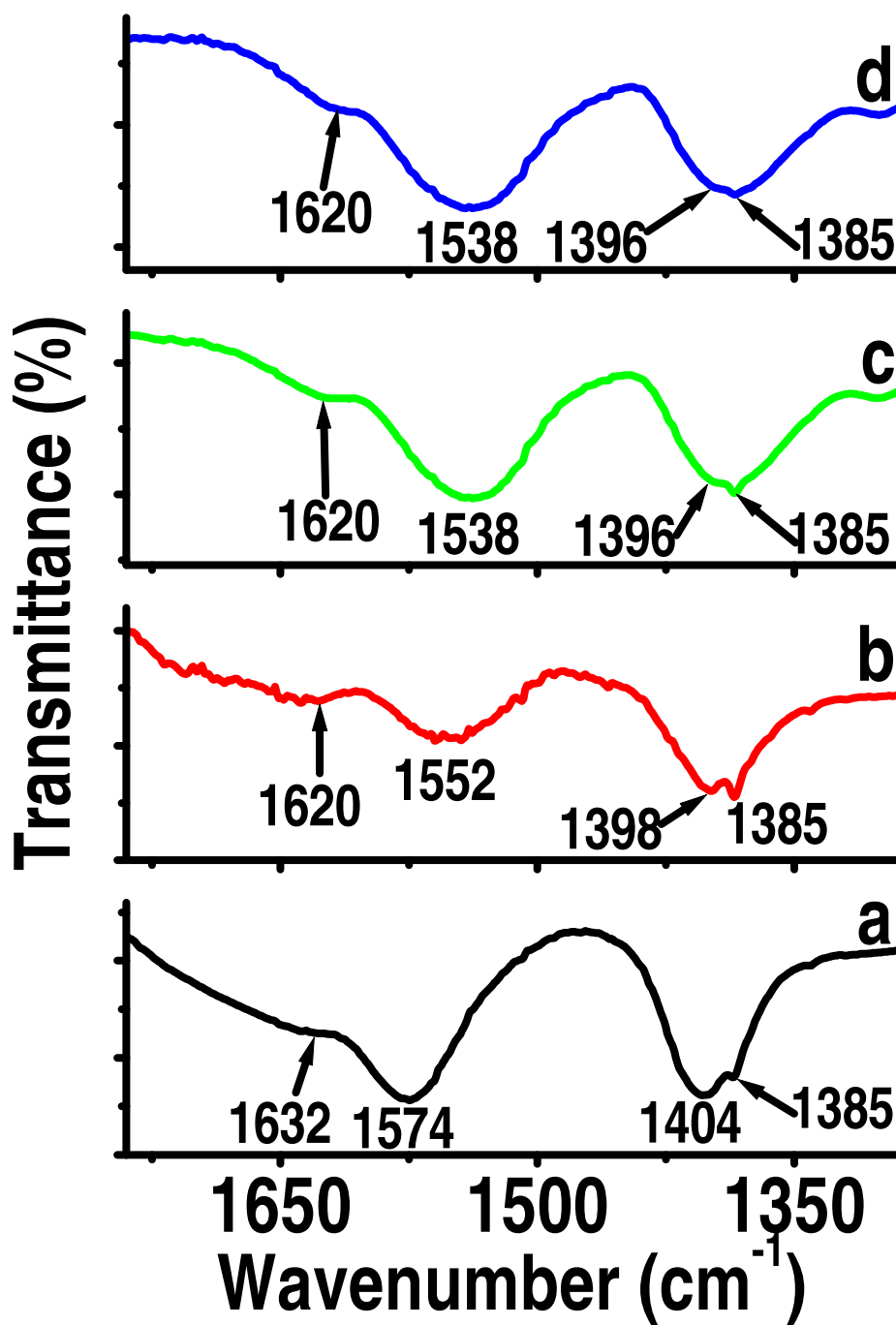


Figure S11. FTIR spectra of $\text{Ag}_{7.8}(\text{MSA})_{7.8}$ clusters treated with 10, 50 and 100 ppm $\text{Pb}(\text{II})$ solutions (traces b, c and d, respectively). Trace a corresponds to parent cluster (shown for comparison).

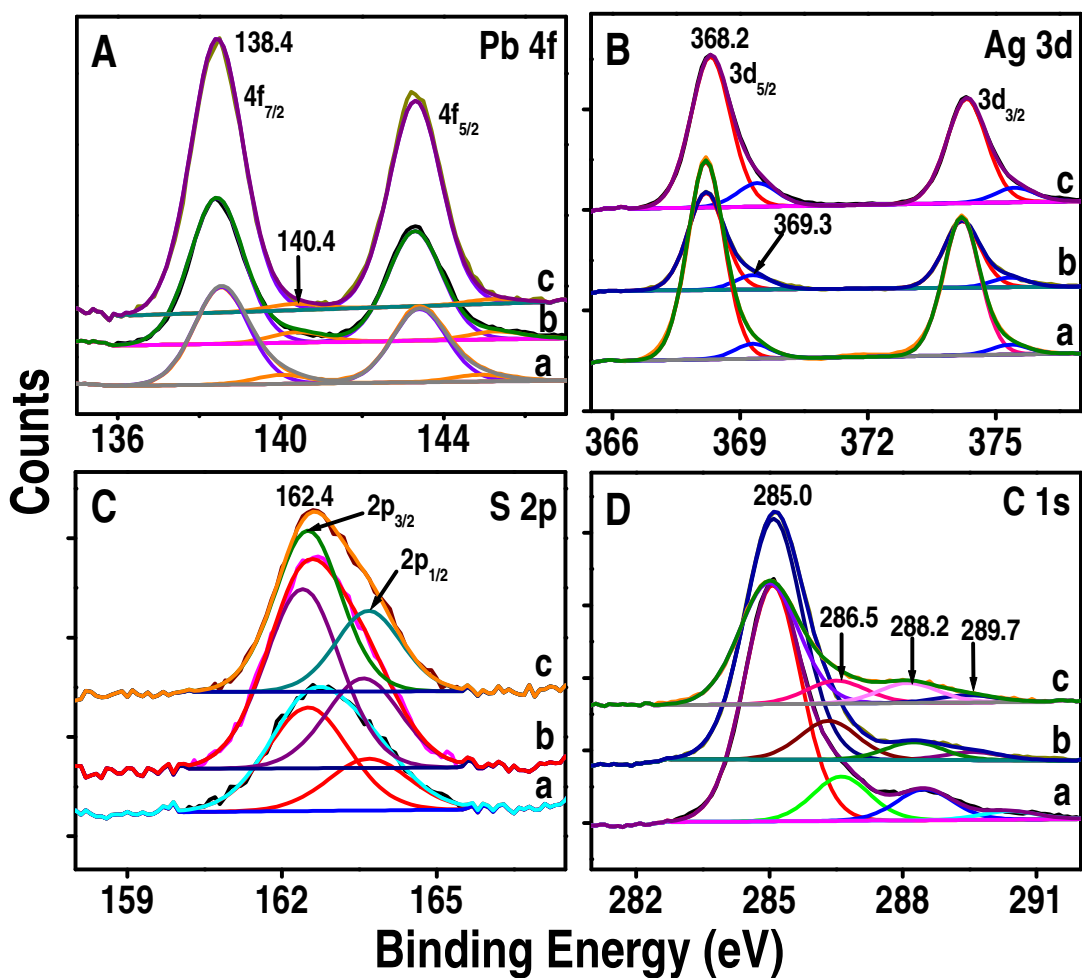


Figure S12. X-ray photoelectron spectra of $\text{Ag}_{7,8}(\text{MSA})_{7,8}$ clusters treated with 10, 50 and 100 ppm $\text{Pb}(\text{II})$ solutions (traces a, b and c, respectively). $\text{Pb } 4f$, $\text{Ag } 3d$, $\text{S } 2p$ and $\text{C } 1s$ regions are shown in A, B, C and D, respectively.

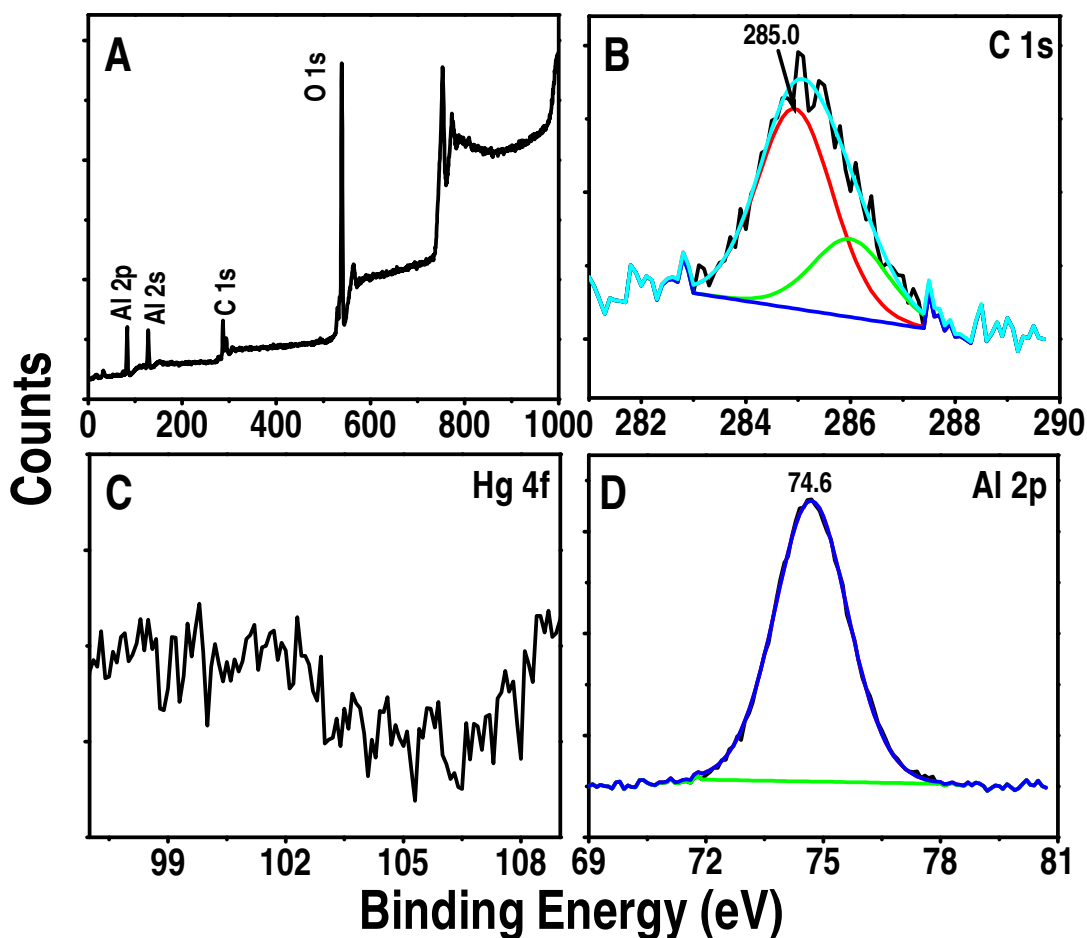


Figure S13. X-ray photoelectron survey spectrum (A) of pure neutral alumina treated with 100 ppm Hg(II) solution. B, C and D are C 1s, Hg 4f and Al 2p regions, respectively. In Figure C no presence of mercury is observed.

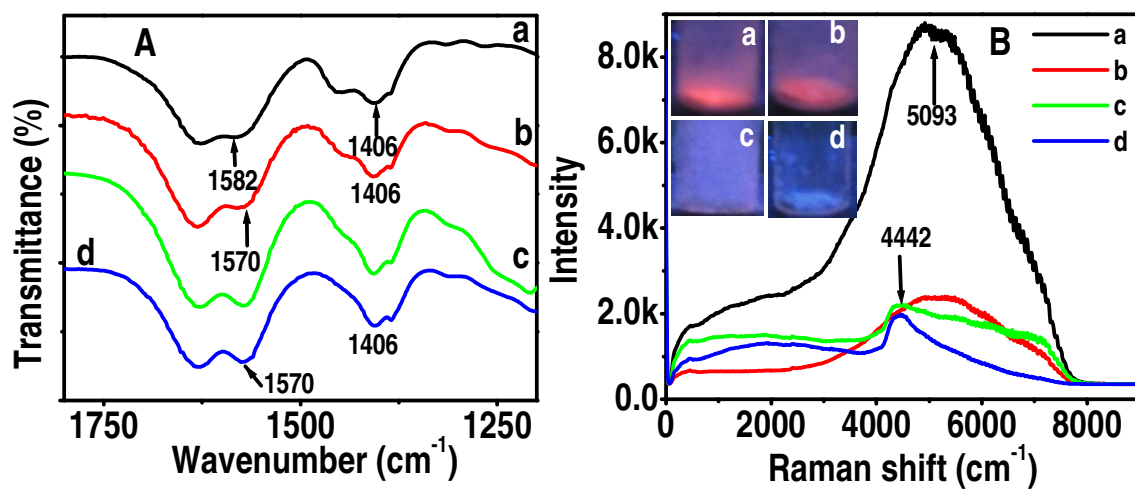


Figure S14. A) FTIR and B) Raman spectra of the $\text{Ag}_{7,8}(\text{MSA})_{7,8}@\text{Al}_2\text{O}_3$ treated with 10, 50 and 100 ppm $\text{Hg}(\text{II})$ solutions (traces b, c and d). Raman spectra show the luminescence from the cluster peaking at 5093 cm^{-1} . Trace a is the parent $\text{Ag}_{7,8}(\text{MSA})_{7,8}@\text{Al}_2\text{O}_3$. The photographs of $\text{Hg}(\text{II})$ treated clusters are shown as inset of B which were taken under a UV lamp at liquid nitrogen temperature. The blue color is due to moisture around the bottle which scatters the UV light. Decrease in emission in the exposed samples is seen.

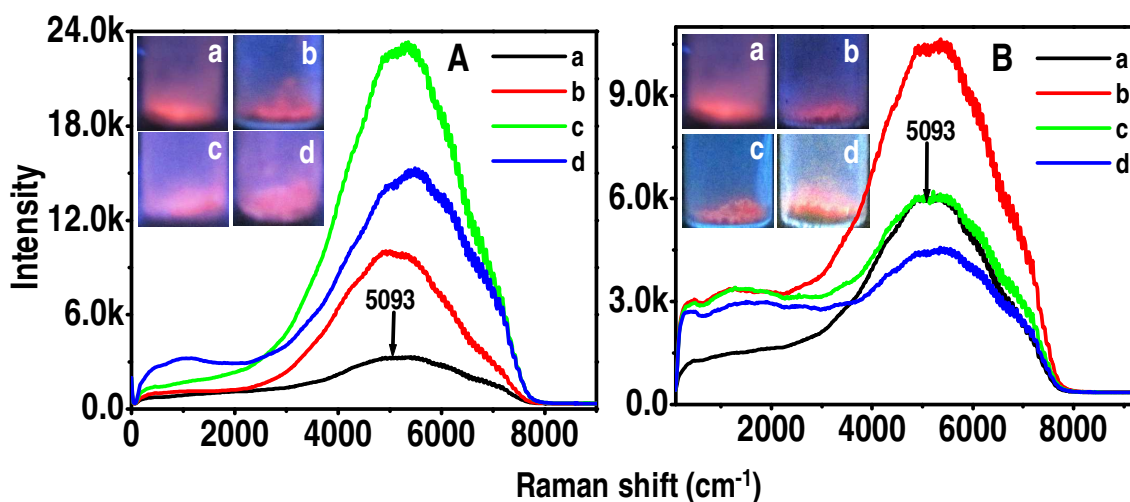


Figure S15. Raman spectra of the $\text{Ag}_{7,8}(\text{MSA})_{7,8}@\text{Al}_2\text{O}_3$ treated with $\text{Cd}(\text{II})$ and $\text{Pb}(\text{II})$ (A and B, respectively) solutions of 10, 50 and 100 ppm (traces b, c and d, respectively). Trace a is the parent $\text{Ag}_{7,8}(\text{MSA})_{7,8}@\text{Al}_2\text{O}_3$. The photographs of metal ions treated clusters are shown as insets of A and B which were taken under a UV lamp at liquid nitrogen temperature. The blue color in photographs is due to moisture around the bottle which scatters the UV light.