

Supporting Information

Optimizing ZIF-8 Membrane Growth on Top of Semiconductive Ga-Doped ZnO Sensitive Layers

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I. Scanning Electron Microscopy Analysis

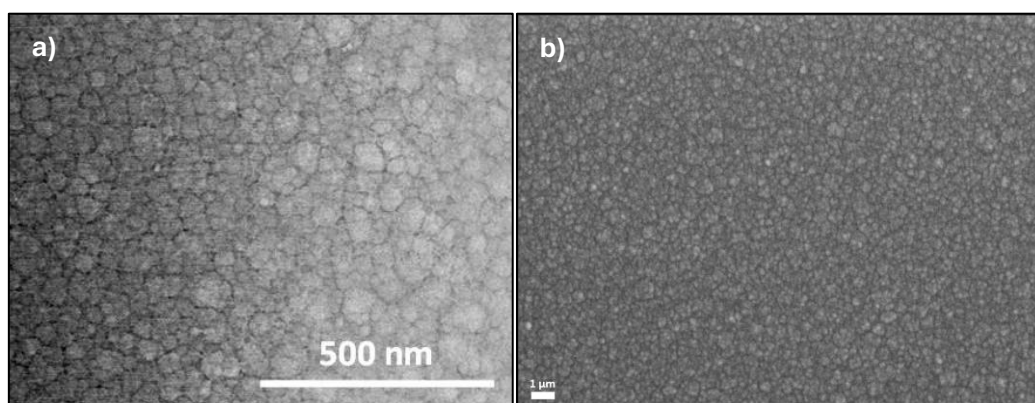


Figure S1. SEM observations (surface view) of a) a bare substrate covered by SiO₂ and b) a ZnO:Ga sample deposited on a Si/SiO₂ wafer.

Table S1. Comparison of grain size, morphology and surface coverage of samples after ZnO-to-MOF conversion under various conditions (SEM micrograph analysis).

Conversion conditions	Apparent “MOF” crystal size / morphology	Estimated Surface Coverage (%)
Water, ZnO:Ga, 100°C, 12h	No MOF	-
DMF, ZnO:Ga, 100°C, 12h	~ 400 nm Pseudo-cubic	95 %
Ethanol, ZnO:Ga, 100°C, 12h	~ 130 nm Poorly faceted (grain clusters)	99 %
Methanol, ZnO:Ga, 100°C, 12h	~ 3 000 nm Pseudo-cubic	57 %
Methanol/water mixture (1:3), ZnO:Ga, 100°C, 1.5h	~ 800 nm Pseudo-cubic + small particles (30 - 100 nm)	88 %
Methanol/water mixture (1:1), ZnO:Ga, 100°C, 1.5h	~ 150 nm Poorly faceted (grains)	97 %
Methanol/water mixture (3:1), ZnO:Ga, 100°C, 1.5h	Unmeasurable Poorly faceted (grains)	96 %
Methanol/water mixture (3:1), Annealed ZnO:Ga, 100°C, 1.5h	~ 300 nm Poorly faceted	75 %
Methanol/water mixture (3:1), Annealed ZnO:Ga, 200 °C for 1.5 h	~ 80 nm Poorly faceted (grain clusters)	94 %
Methanol/water mixture (3:1), Annealed ZnO:Ga, 100 °C for 12 h	Unmeasurable Poorly faceted (grains)	82 %

II. Energy-Dispersive X-Ray Spectroscopy

II.1. Effect of Solvent Physicochemical Properties on ZnO:Ga Conversion to ZIF-8

II.1.1. Water Solvent

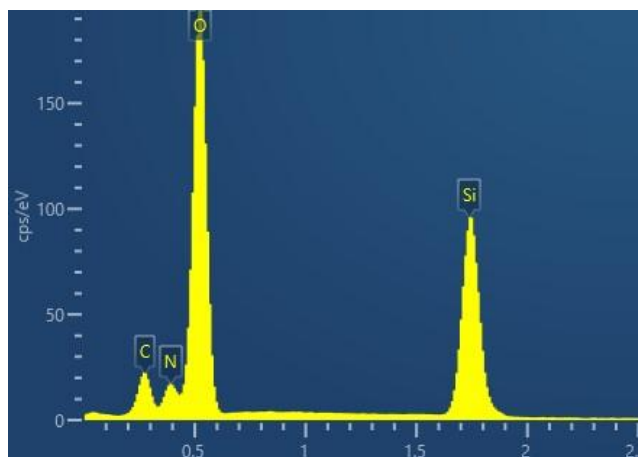


Figure S2. EDX spectrum of a ZnO:Ga sample after reaction at 100°C for 12h in water. The absence of Zn and Ga signals confirms the complete removal of the ZnO layer. The Si and O signals originate from the SiO₂-coated silicon wafer substrate while trace amounts of C and N likely result from residual 2-methylimidazole ligand adsorbed on the surface without participating in ZIF-8 formation.

II.1.2 Dimethylformamide Solvent

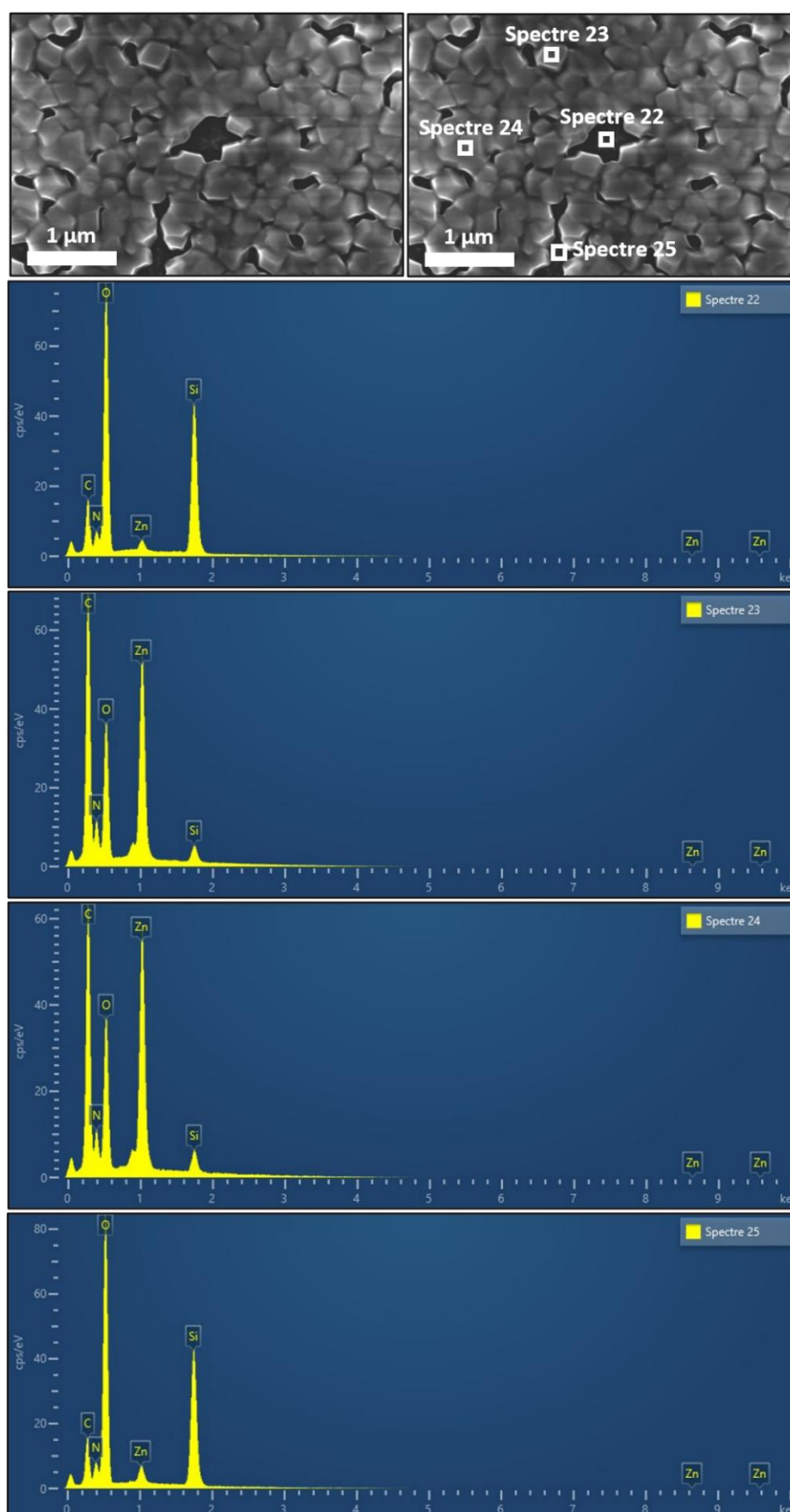


Figure S3. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 12h in DMF.

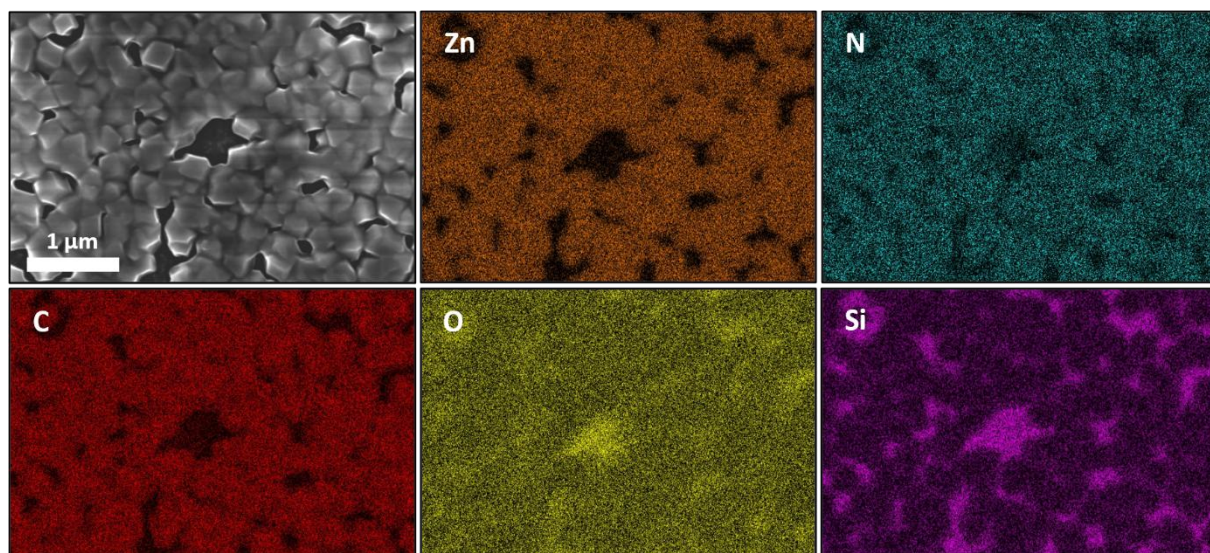


Figure S4. EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 12h in DMF.

II.1.3 Ethanol Solvent

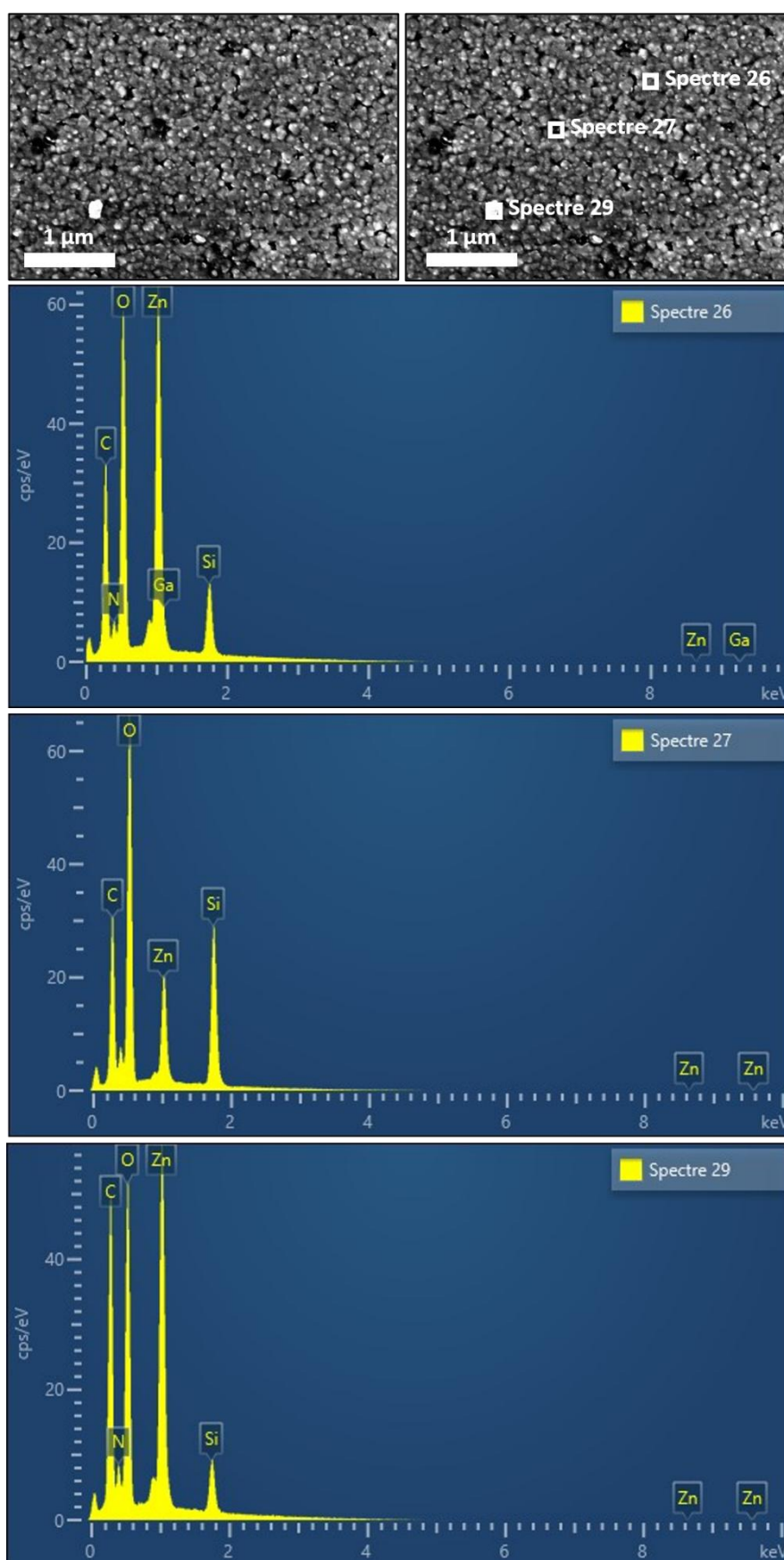


Figure S5. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 12h in ethanol.

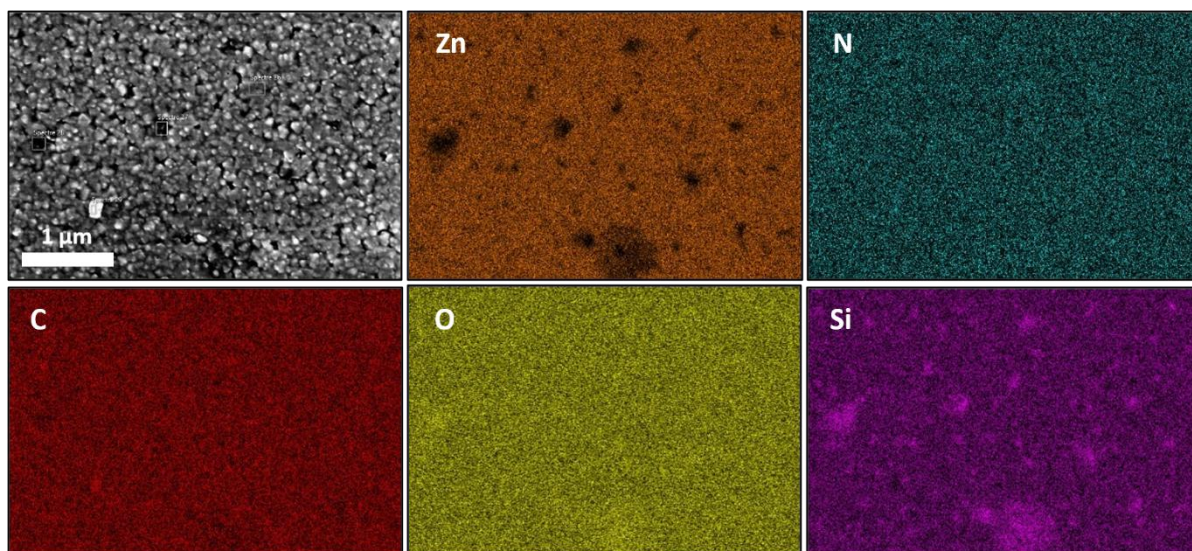


Figure S6. EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 12h in ethanol.

II.1.4 Methanol Solvent

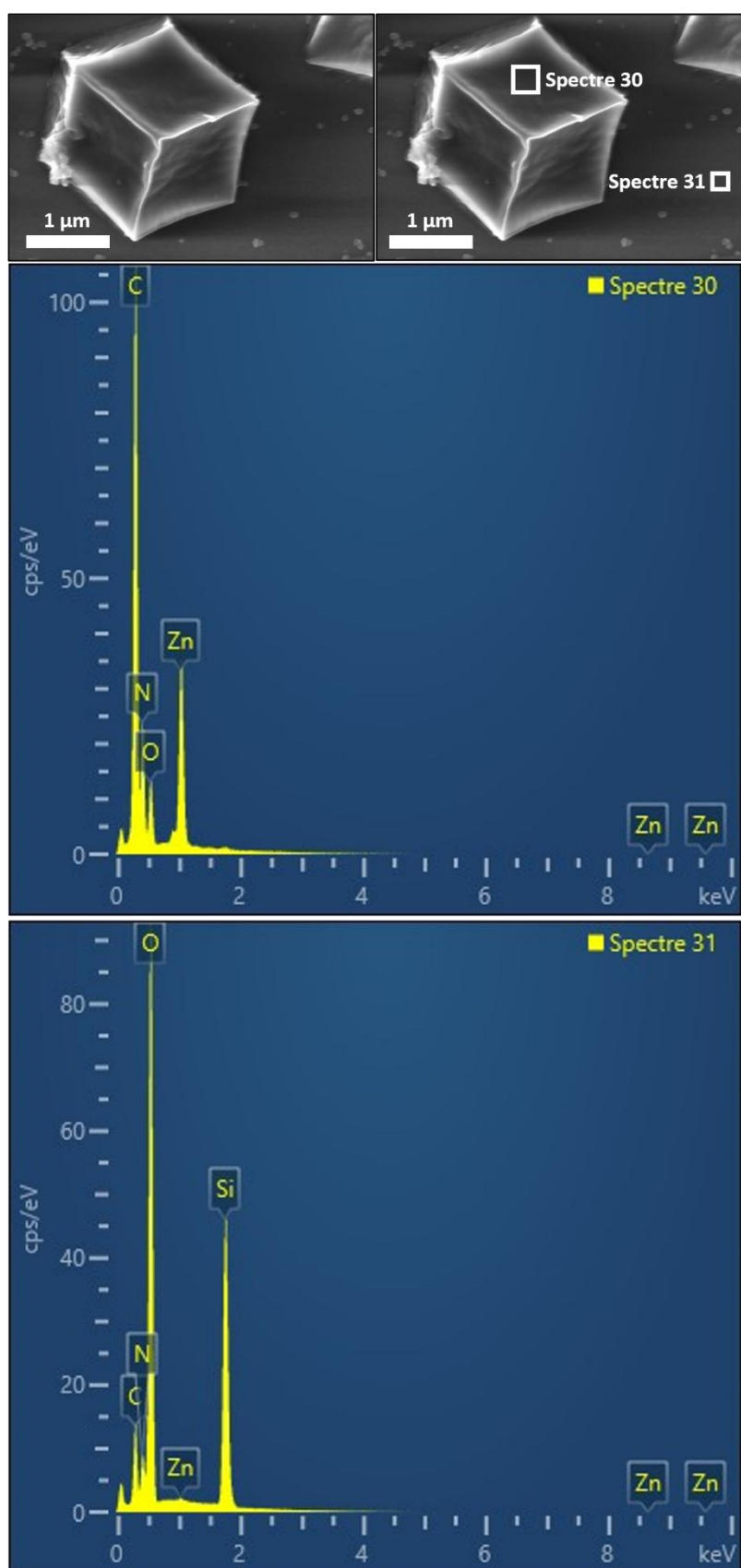


Figure S7. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 12h in methanol.

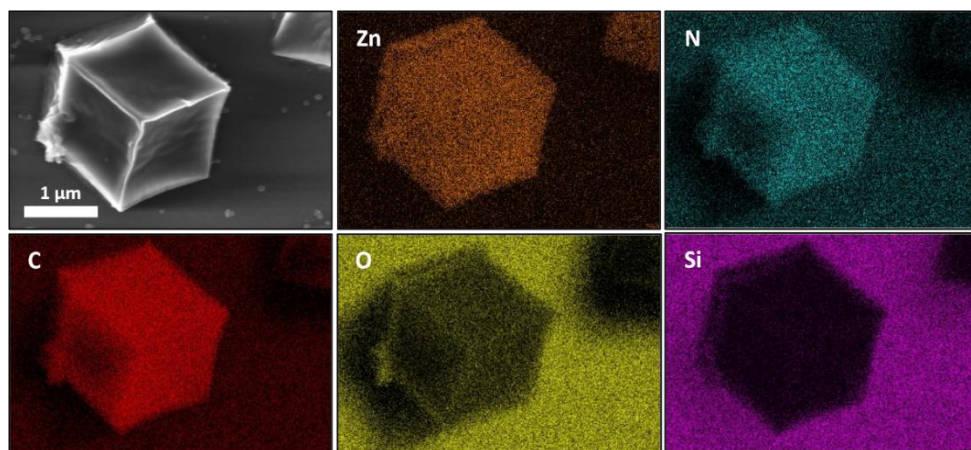


Figure S8. EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 12h in methanol.

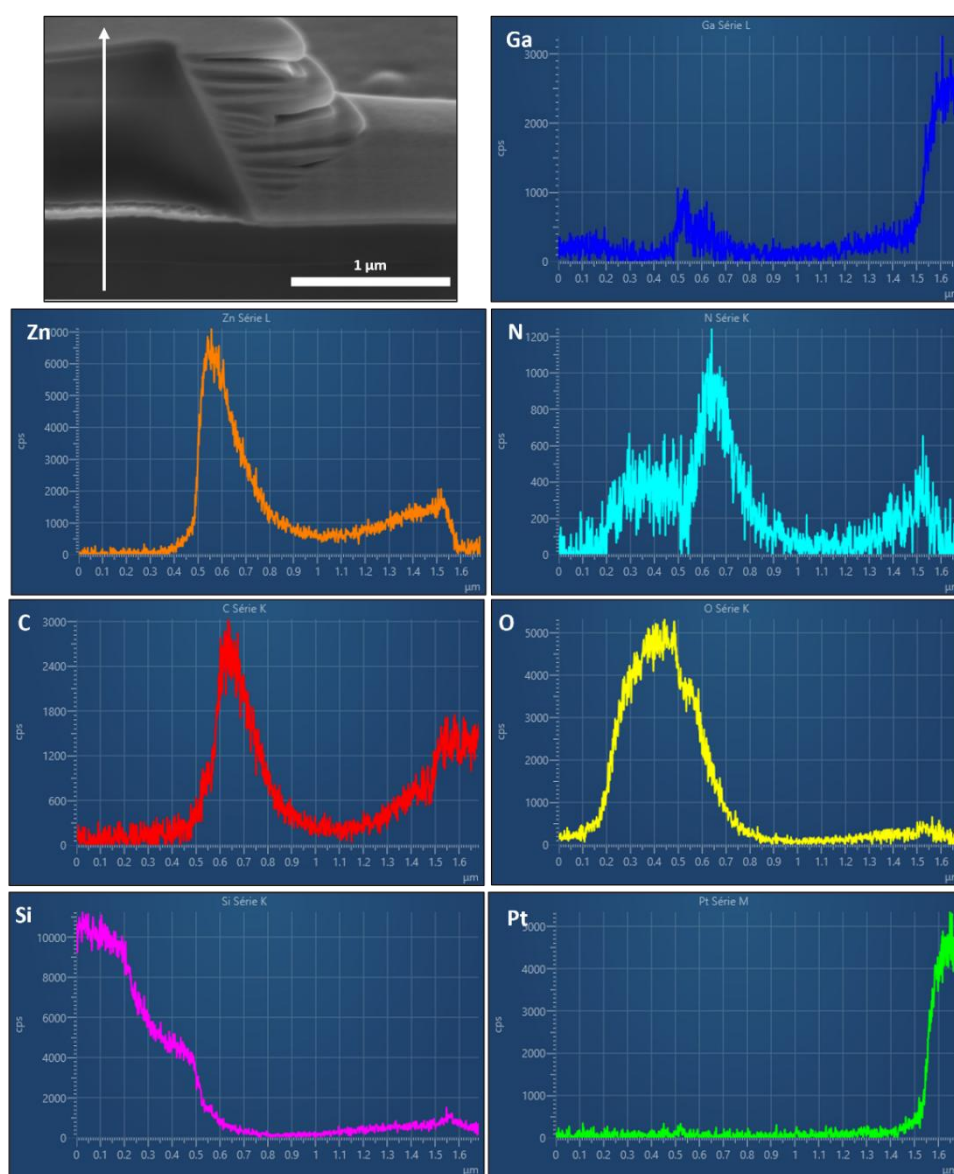


Figure S9. Cross-sectional EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 12h in methanol.

II.2 Effect of MeOH/H₂O volumetric ratio on ZnO:Ga conversion to ZIF-8

II.2.1 Methanol/water mixture (1:3)

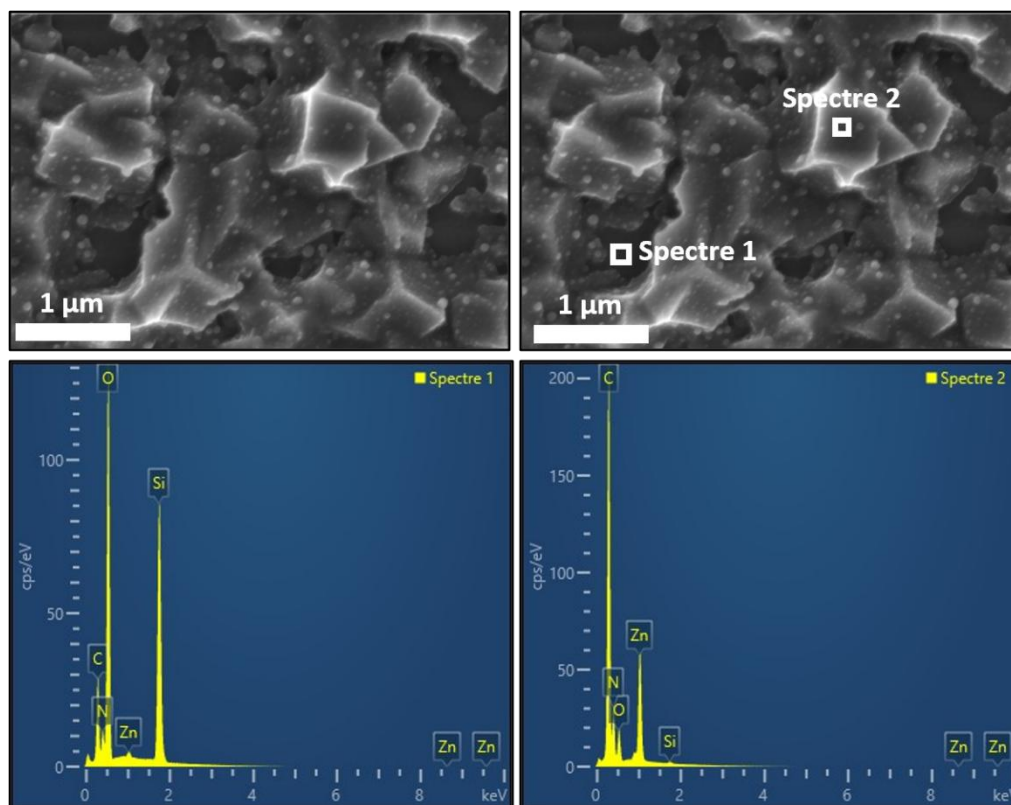


Figure S10. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 1:3.

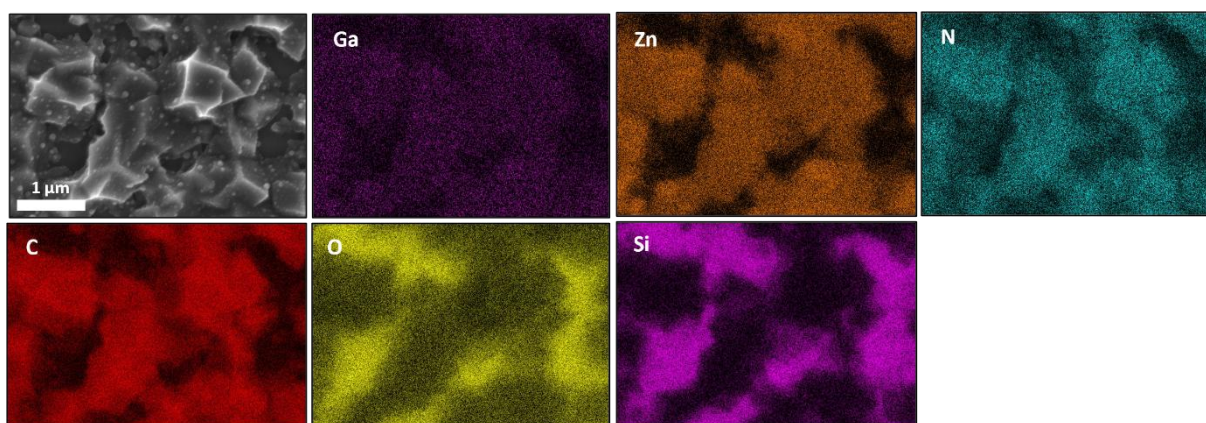


Figure S11. EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 1:3.

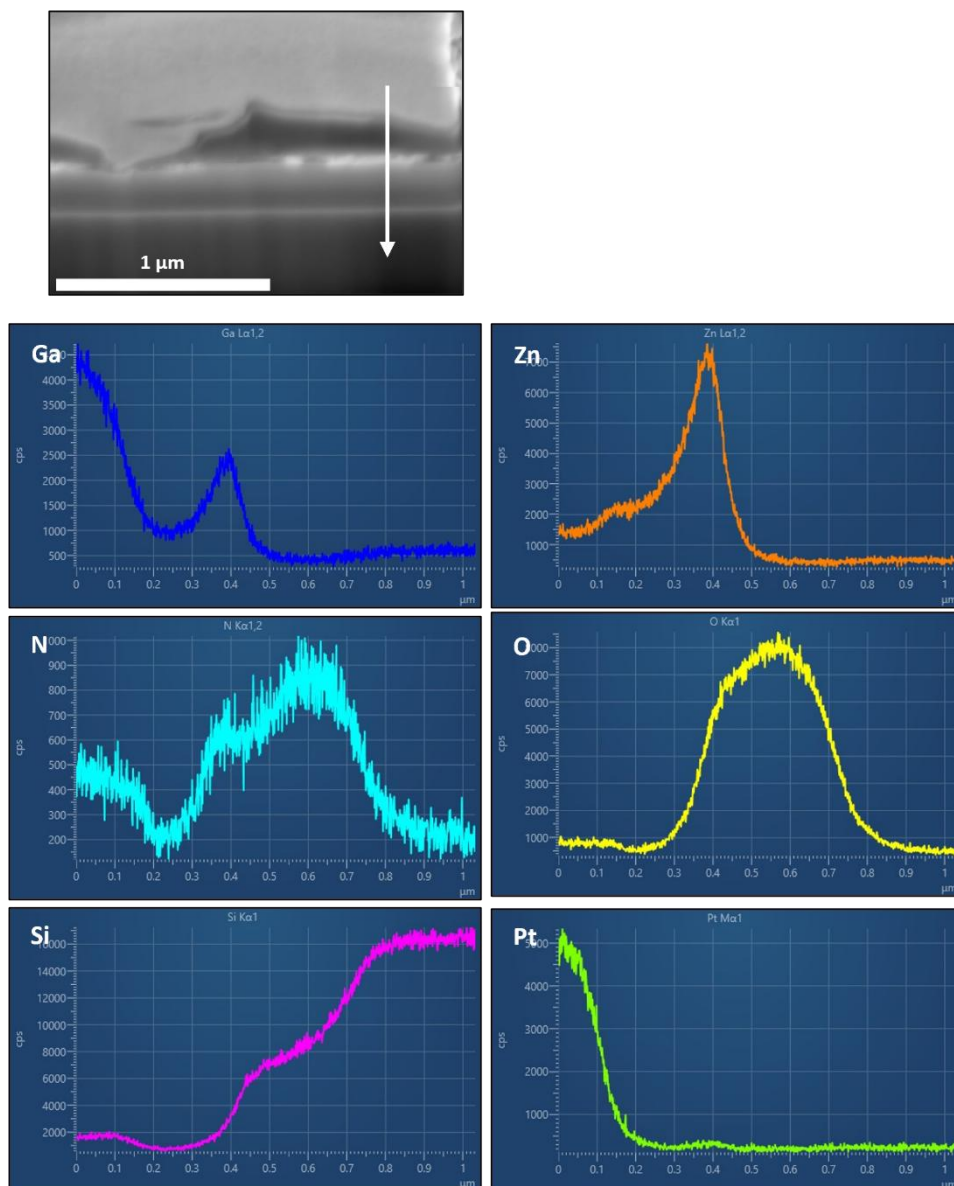


Figure S12. Cross-sectional EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 1:3.

II.2.2 Methanol/water mixture (1:1)

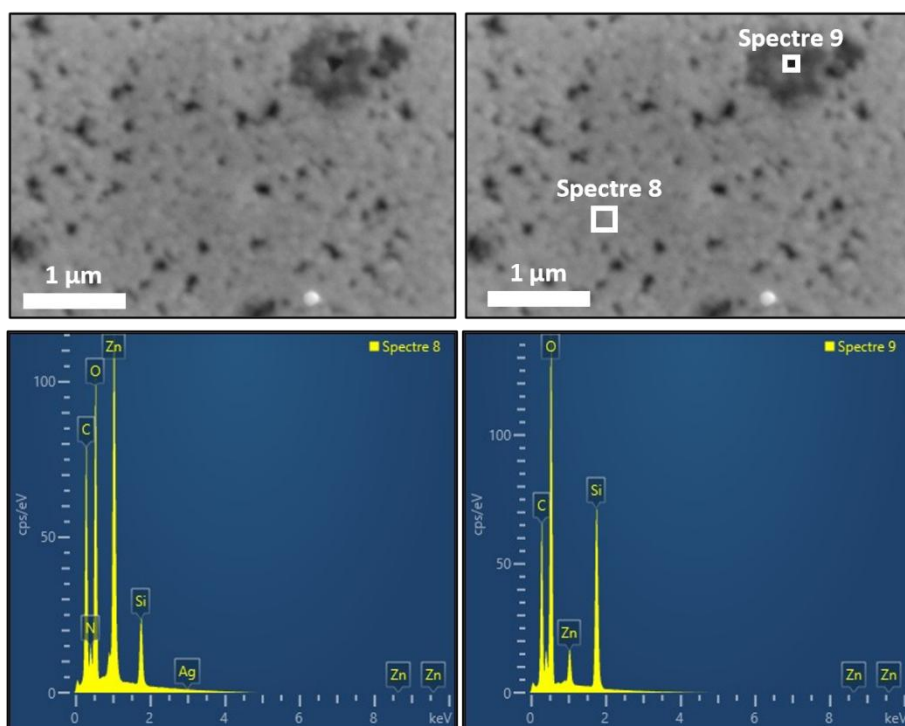


Figure S13. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 1:1.

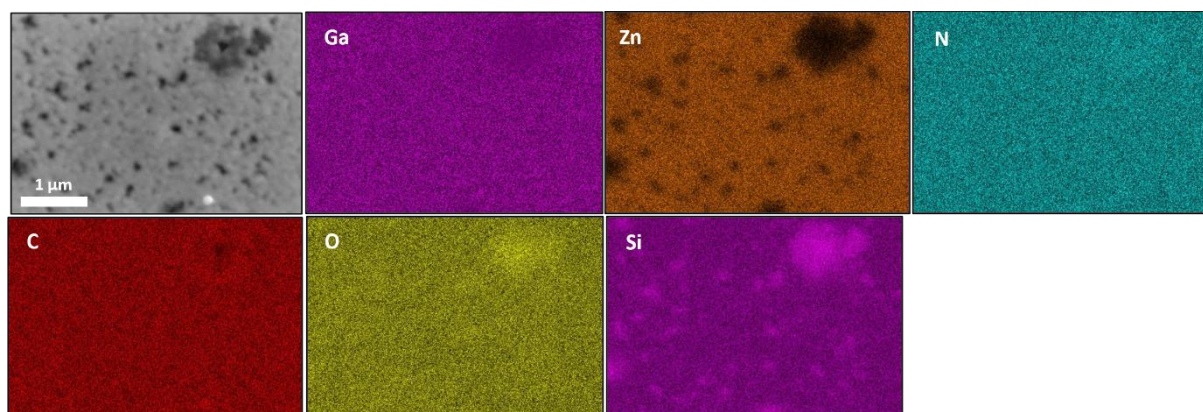


Figure S14. EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 1:1.

II.2.3 Methanol/water mixture (3:1)

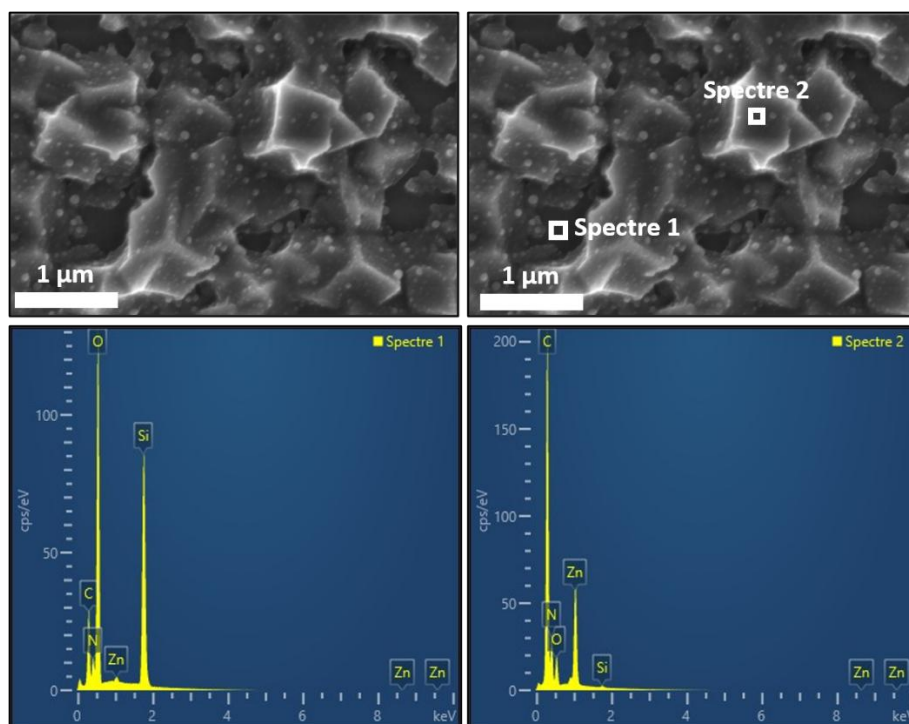


Figure S15. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 3:1.

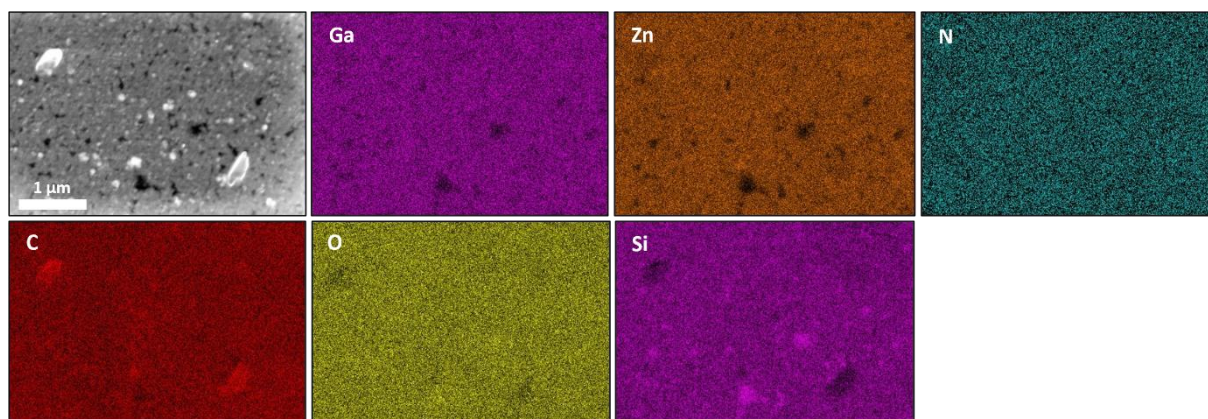


Figure S16. EDX mapping analysis of ZnO:Ga samples after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 3:1.

II.2.4 Methanol

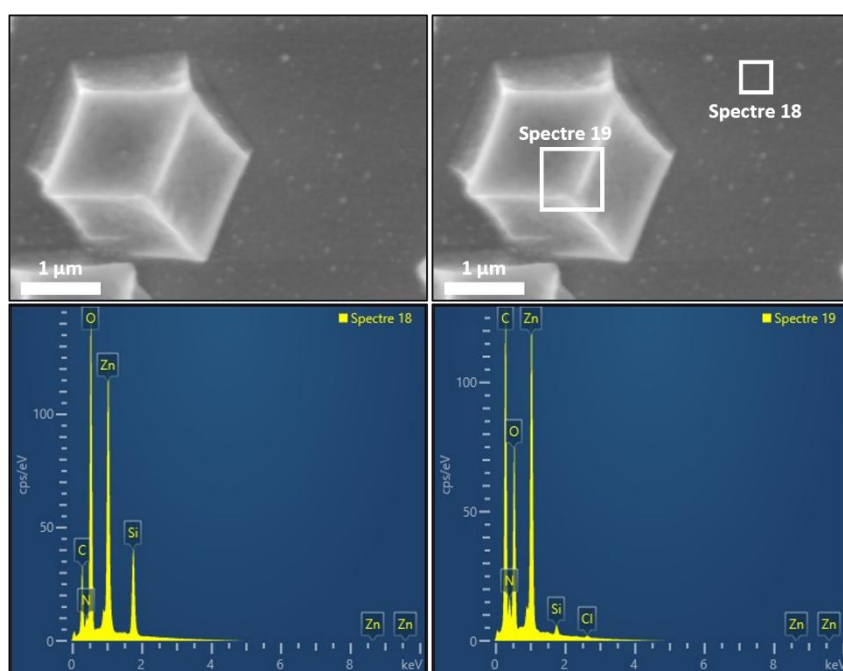


Figure S17. EDX spectra of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol.

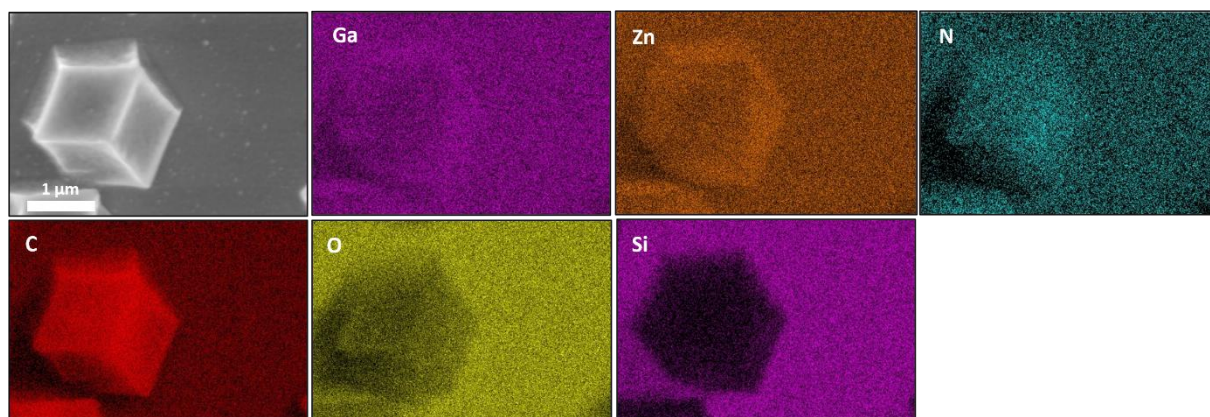


Figure S18. EDX mapping analysis of a ZnO:Ga sample after conversion at 100°C for 1.5h in methanol.

II.3. Effect of Solvent Physicochemical Properties on ZnO:Ga Conversion to ZIF-8

II.3.1. Conversion at 100°C for 1.5h

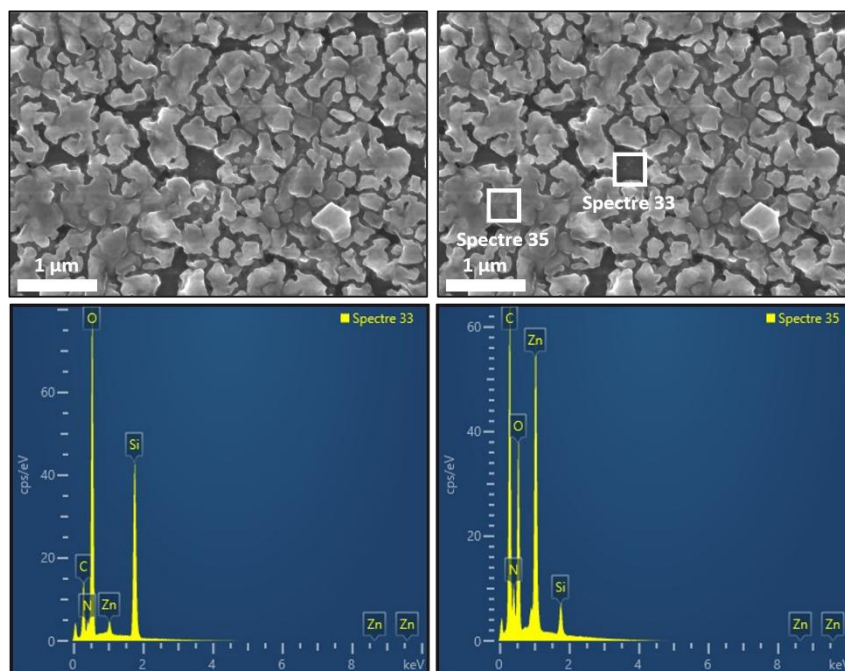


Figure S19. EDX spectra of an annealed ZnO:Ga sample after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 3:1.

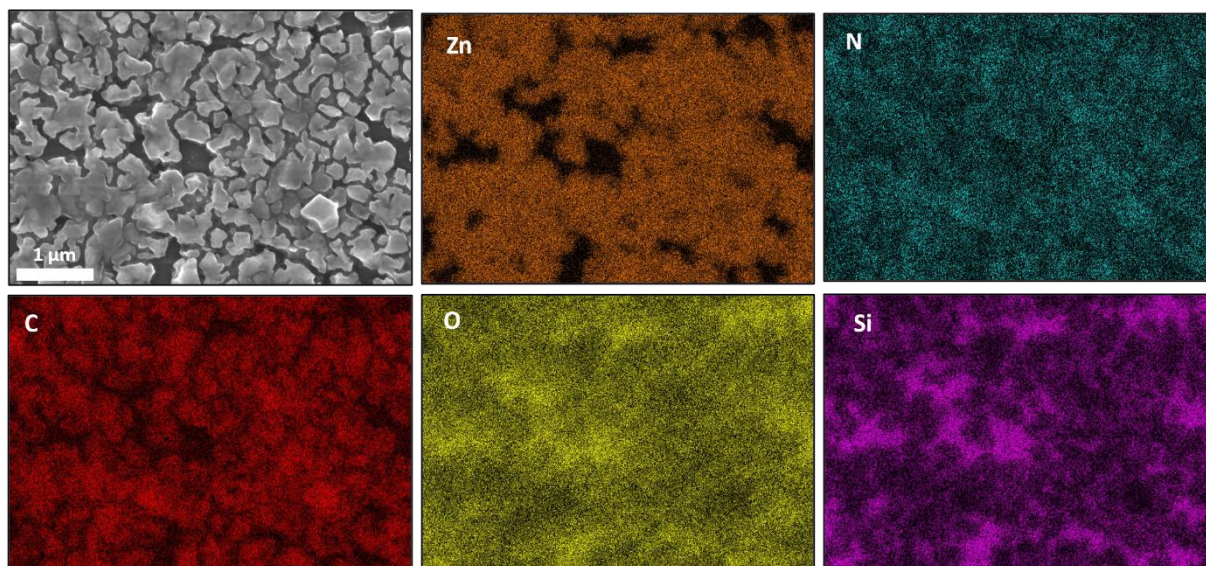


Figure S20. EDX mapping analysis of annealed ZnO:Ga samples after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 3:1.

II.3.2. Conversion at 200°C for 1.5h

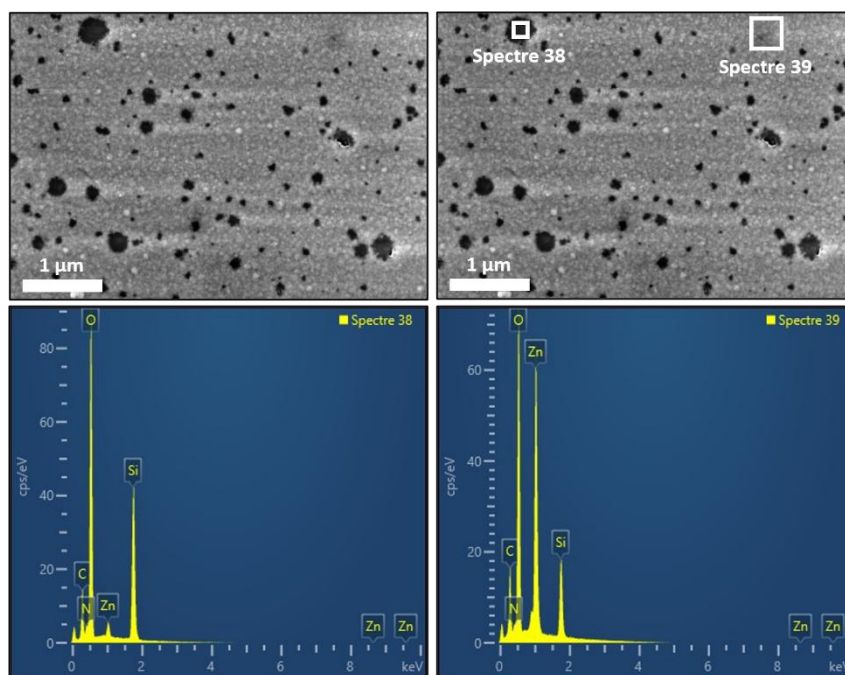


Figure S21. EDX spectra of an annealed ZnO:Ga sample after conversion at 200°C for 1.5h in methanol/water solvent mixture with ratio 3:1.

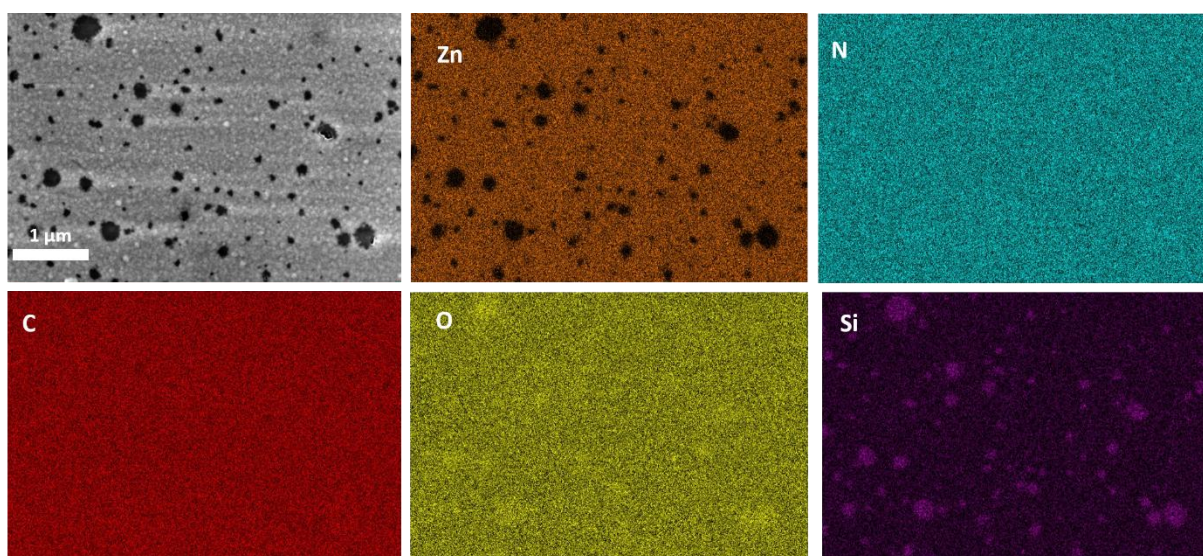
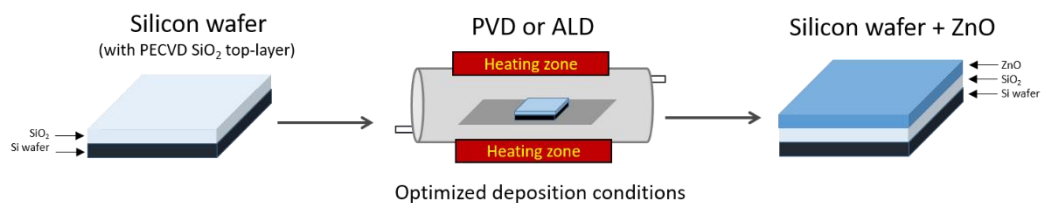


Figure S22. EDX mapping analysis of annealed ZnO:Ga samples after conversion at 100°C for 1.5h in methanol/water solvent mixture with ratio 3:1.

III. Synthesis Protocol

a) ZnO Layer Deposition



b) ZnO Surface Conversion to ZIF-8

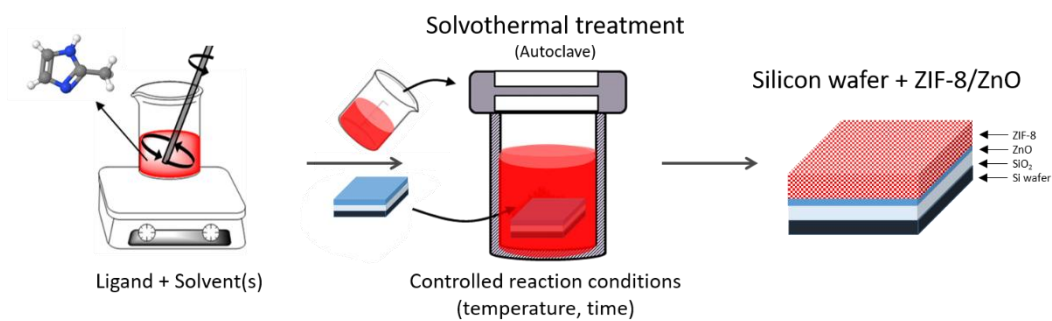


Figure S23. Schematic illustration of the two-step process for synthesizing ZIF-8@ZnO on a Si wafer.