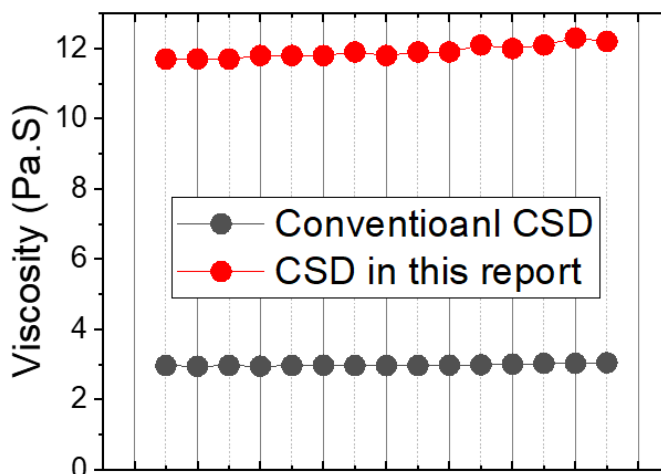


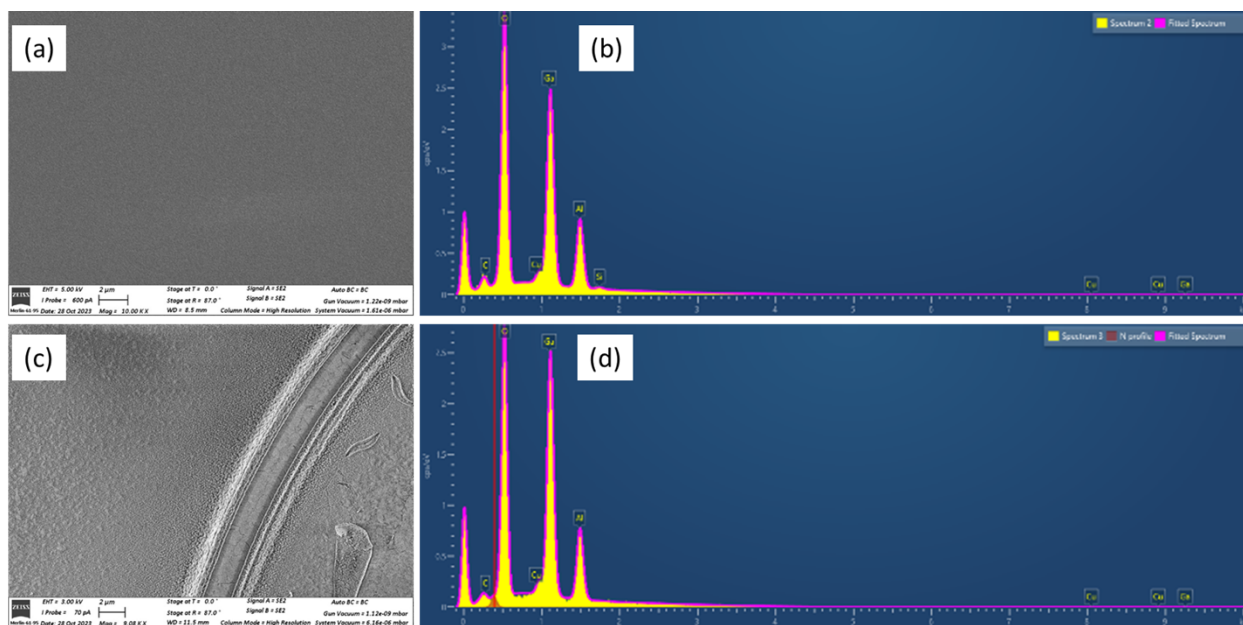
## Supporting information

### Conventional preparation of the $\text{Ga}_2\text{O}_3$ precursor solution:

Analytical grade gallium nitrate hydrate  $\text{Ga}(\text{NO}_3)_3$  was initially dissolved in a mixture of 2-methoxyethanol  $\text{C}_3\text{H}_8\text{O}_2$  and monoethanolamine (MEA;  $\text{C}_2\text{H}_7\text{NO}$ ) at room temperature. The concentration of this solution was maintained at 0.5 mol/L, ensuring the molar ratio of MEA to gallium nitrate hydrate remained at 1.0. Subsequently, the solution was stirred at 60 °C for 1 hour to achieve a clear and homogeneous mixture.



**Figure S1.** Viscosity of the precursor solution described in this report and that using conventional recipe.



**Figure S2.** SEM images and the corresponding EDX patterns for sample GA (a, b) and sample GAS (c,d).