†Electronic Supplementary Information (ESI)

A novel electroluminescent device based on reduced graphene oxide wrapped phosphor (ZnS:Cu, Al) and hexagonal-boron nitride for high-performance luminescence

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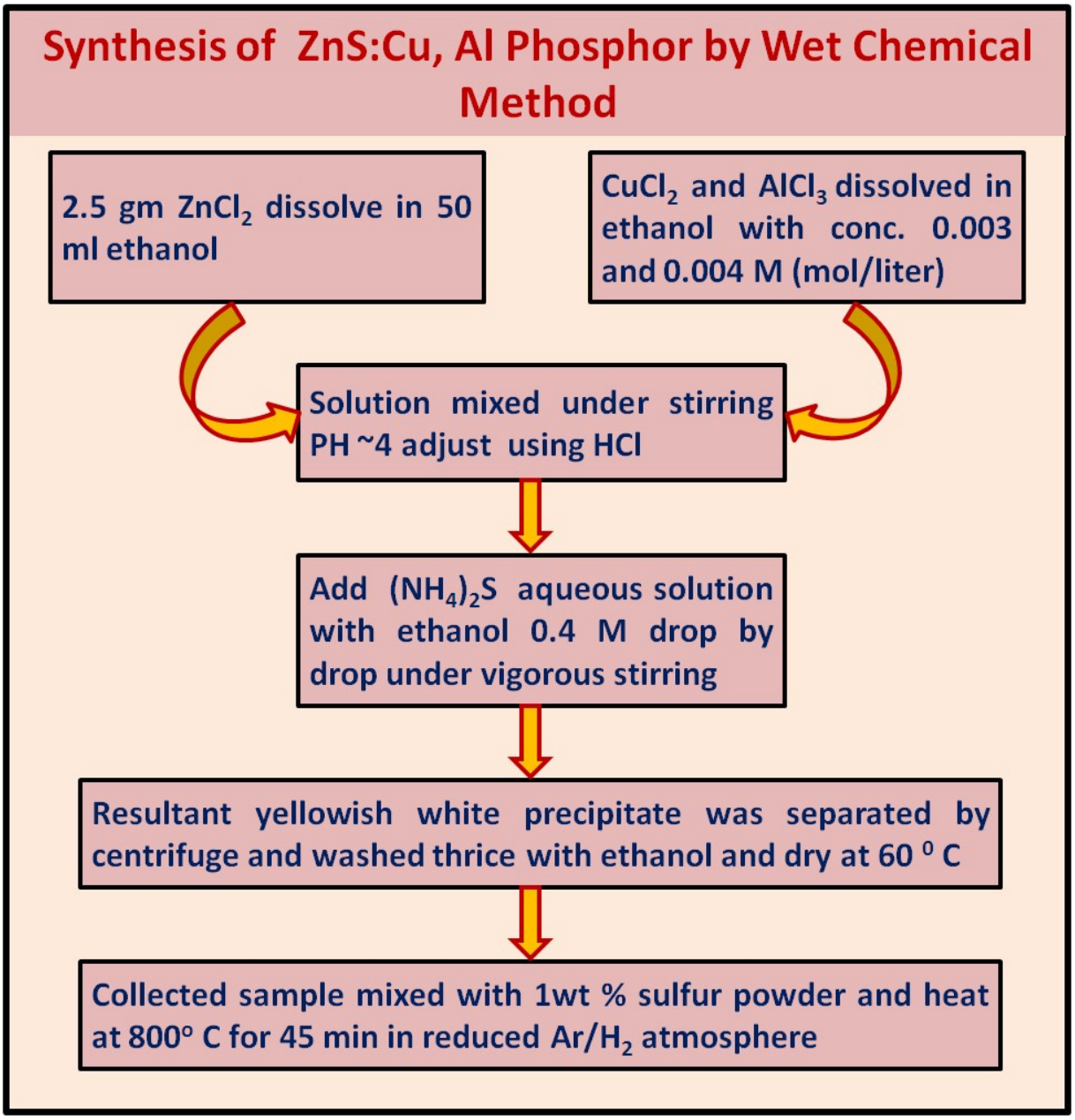
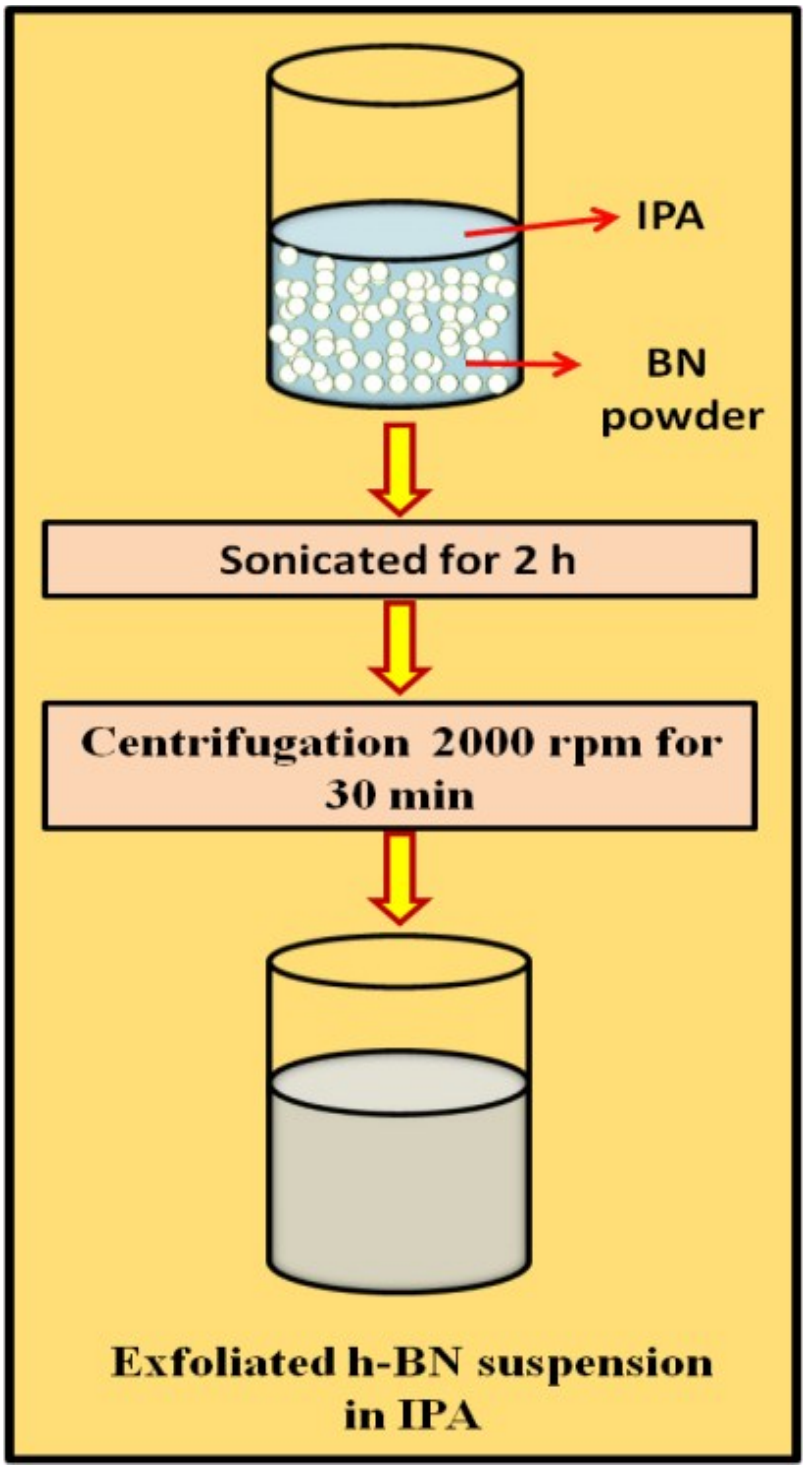


Scheme S1: Flow chart for the synthesis of ZnS:Cu,Al phosphor by chemical solution method.



Scheme S2. Schematic diagram for synthesis of exfoliated h-BN layer.

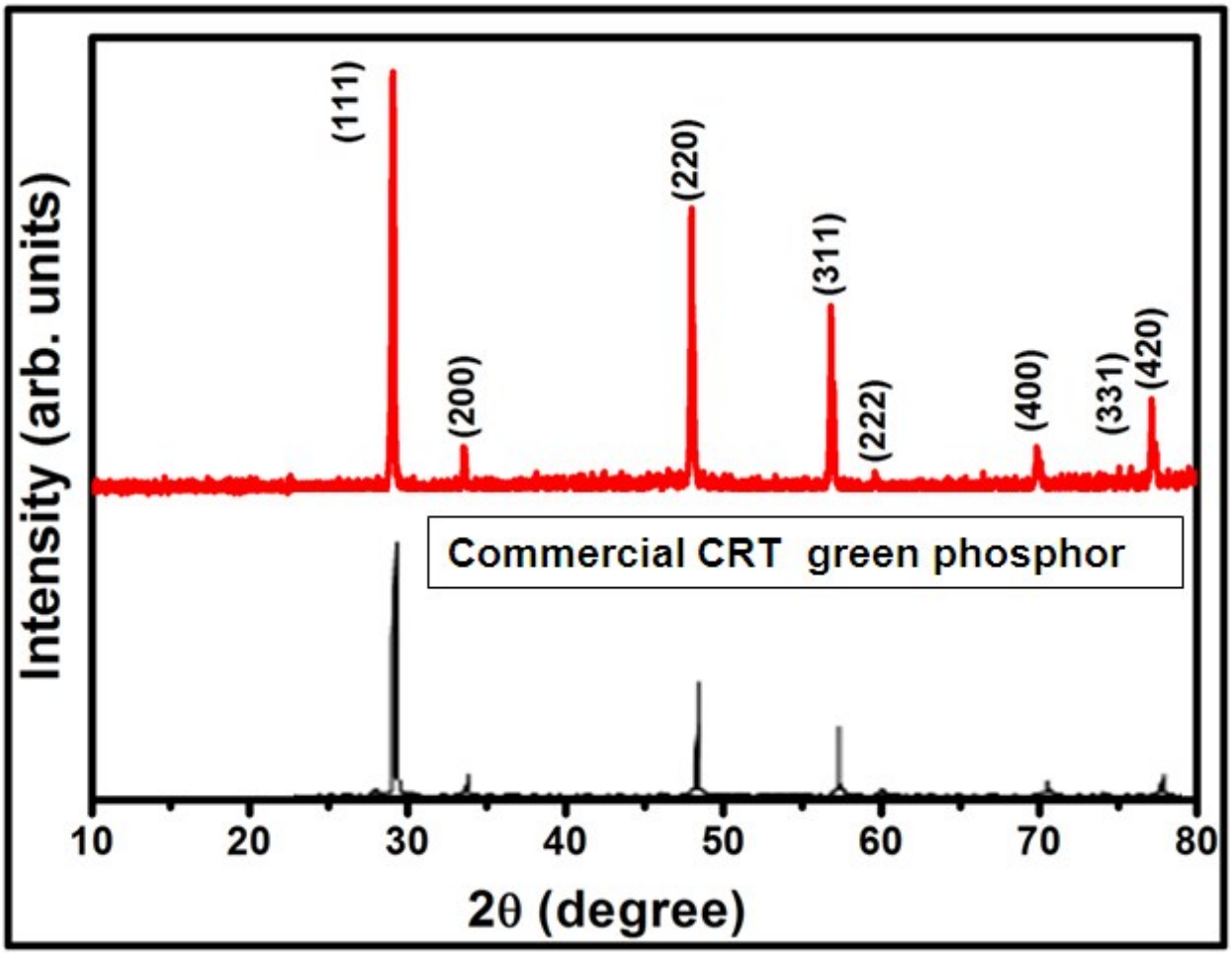


Fig. S1: XRD pattern of ZnS: Cu,Al phosphor; commercially available sample (black spectrum) and the modified wet-chemical synthesized sample (red spectrum).

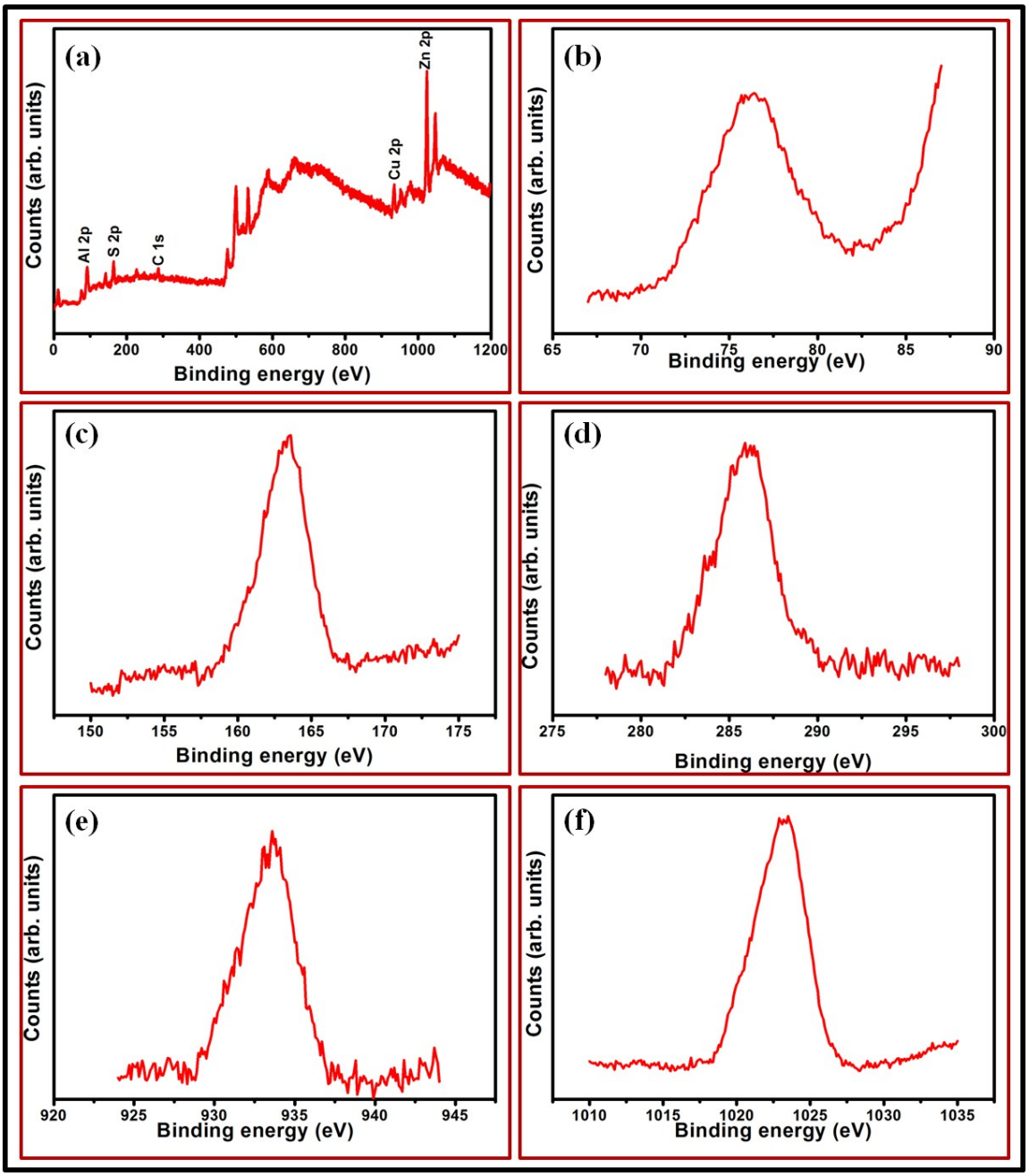


Fig. S2: (a) survey-scanned XPS spectrum of the as-synthesized ZnS:Cu,Al phosphor, XPS core level spectra of (b) Al2p, (c) S2p, (d) C1s, (e) Cu2p and (f) Zn2p regions for the ZnS:Cu,Al phosphor.

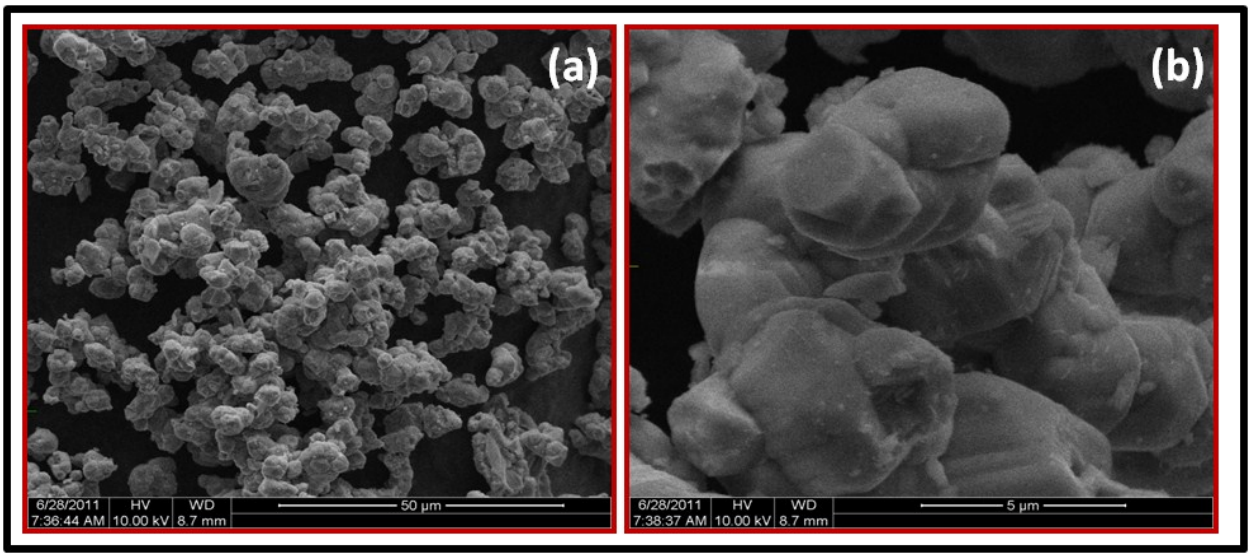


Fig. S3: (a) SEM image of ZnS : Cu, Al phosphor sample and (b) enlarge view of (a).

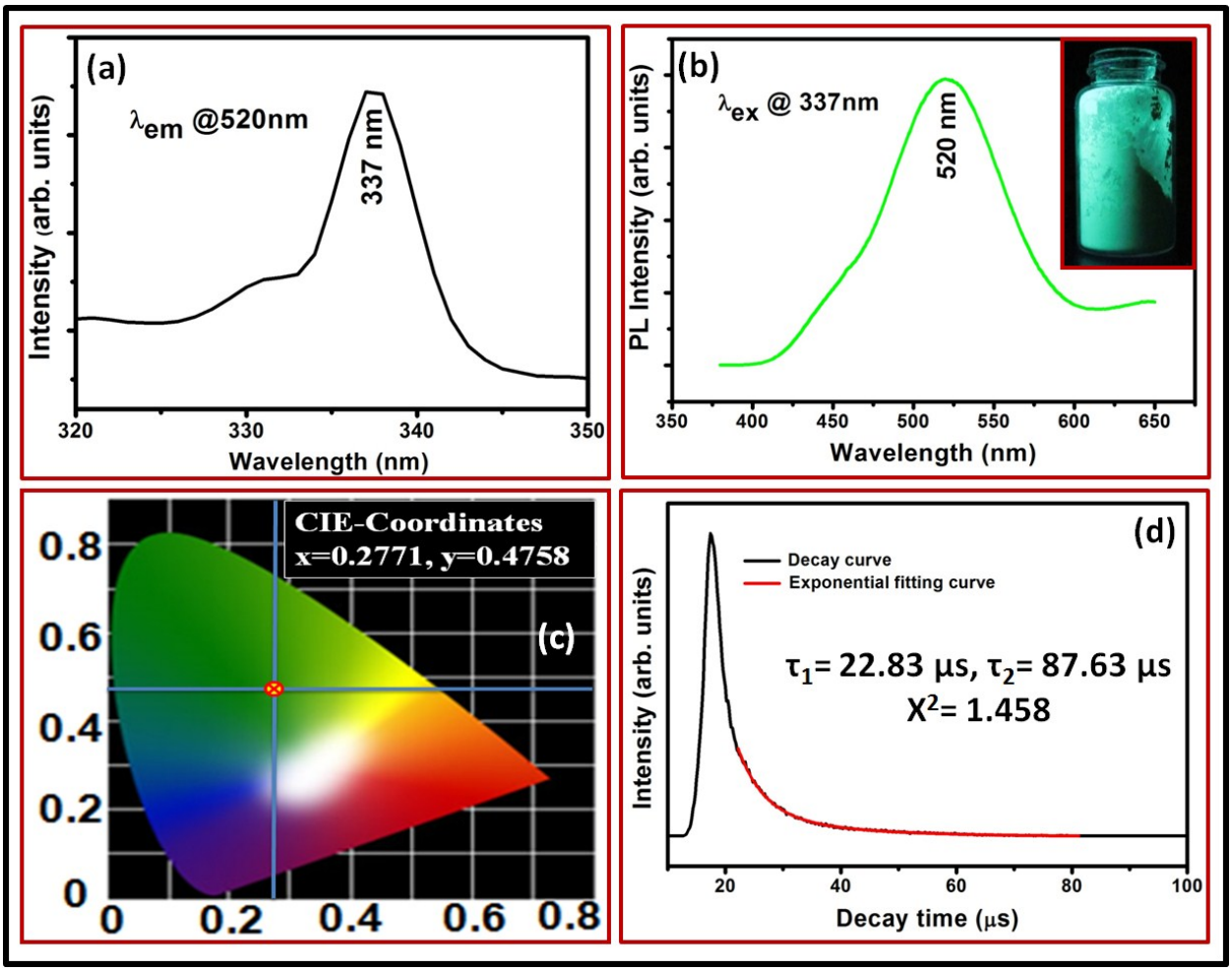


Fig. S4. (a) PLE and (b) PL spectrum of ZnS : Cu, Al phosphor sample and inset shows the optical photograph of the ZnS : Cu, Al phosphor sample excited by wavelengths of a 365 nm UV lamp, showing that the strong green emission is largely enhanced, (c) CIE coordinates from emission spectrum of ZnS : Cu, Al phosphor and (d) Time-resolved photoluminescence decay spectra with a fitting curve and their corresponding parameters of ZnS : Cu, Al phosphor .

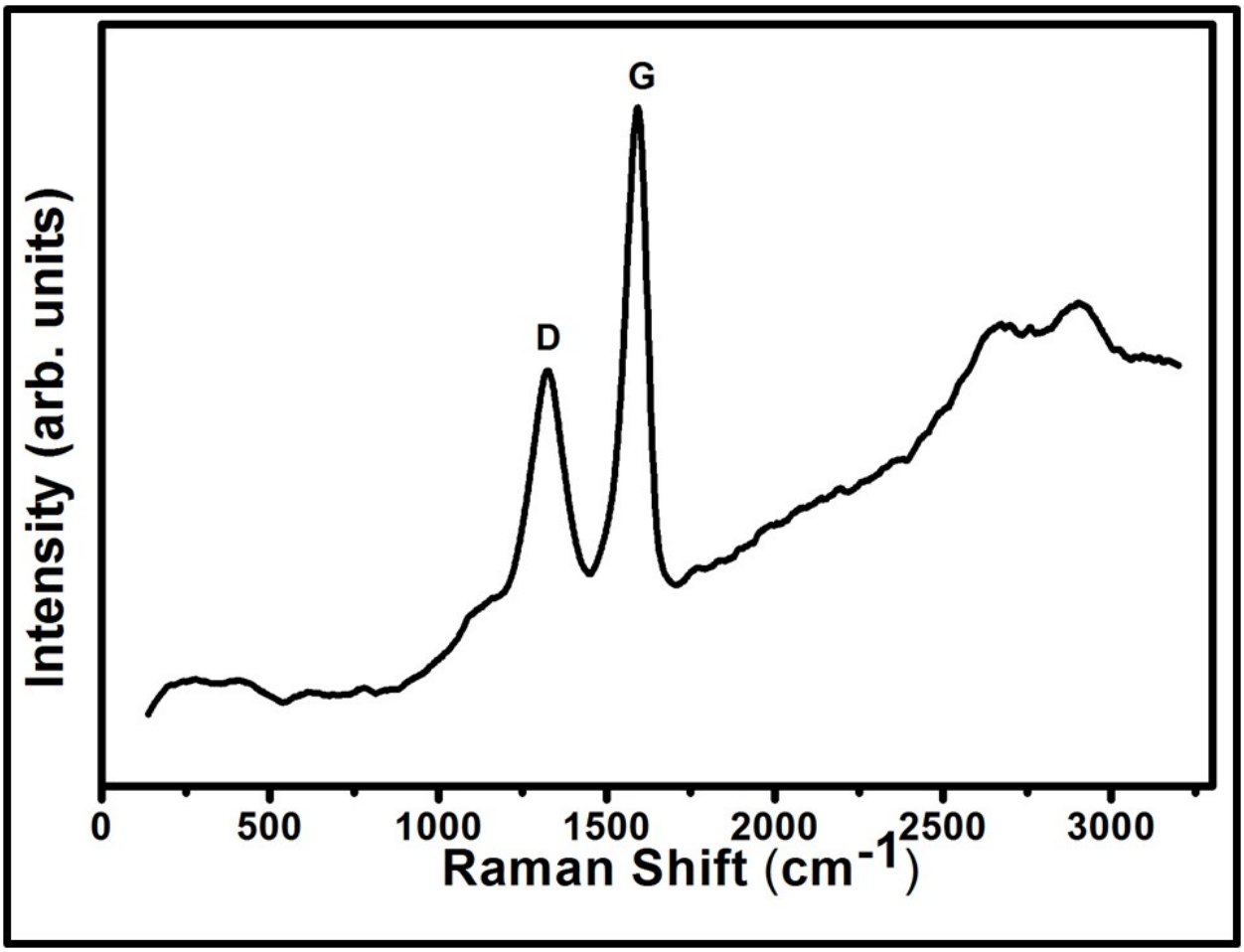


Fig. S5: Raman spectrum of as-synthesized rGO.

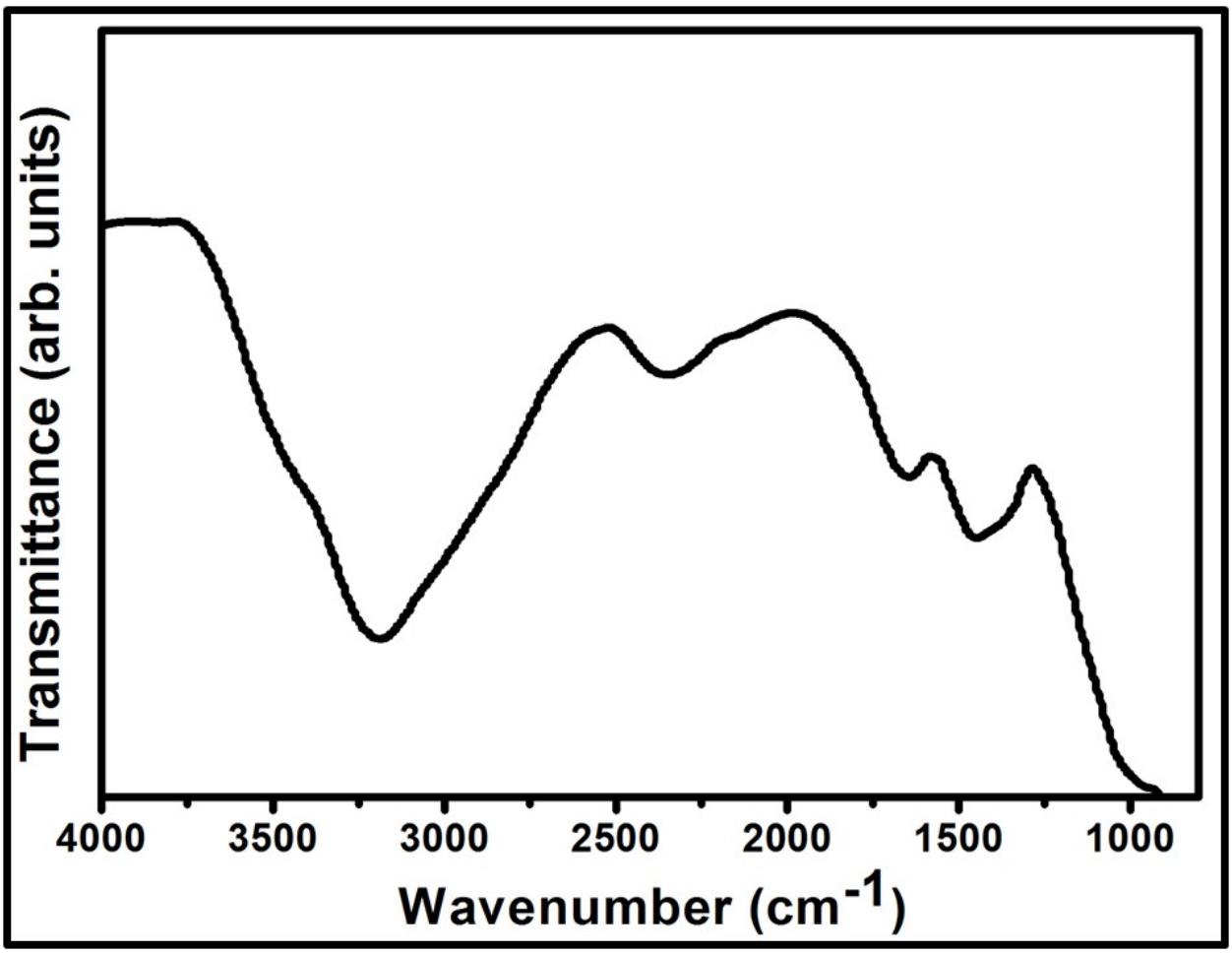


Fig. S6: FTIR spectrum of as-synthesized rGO.

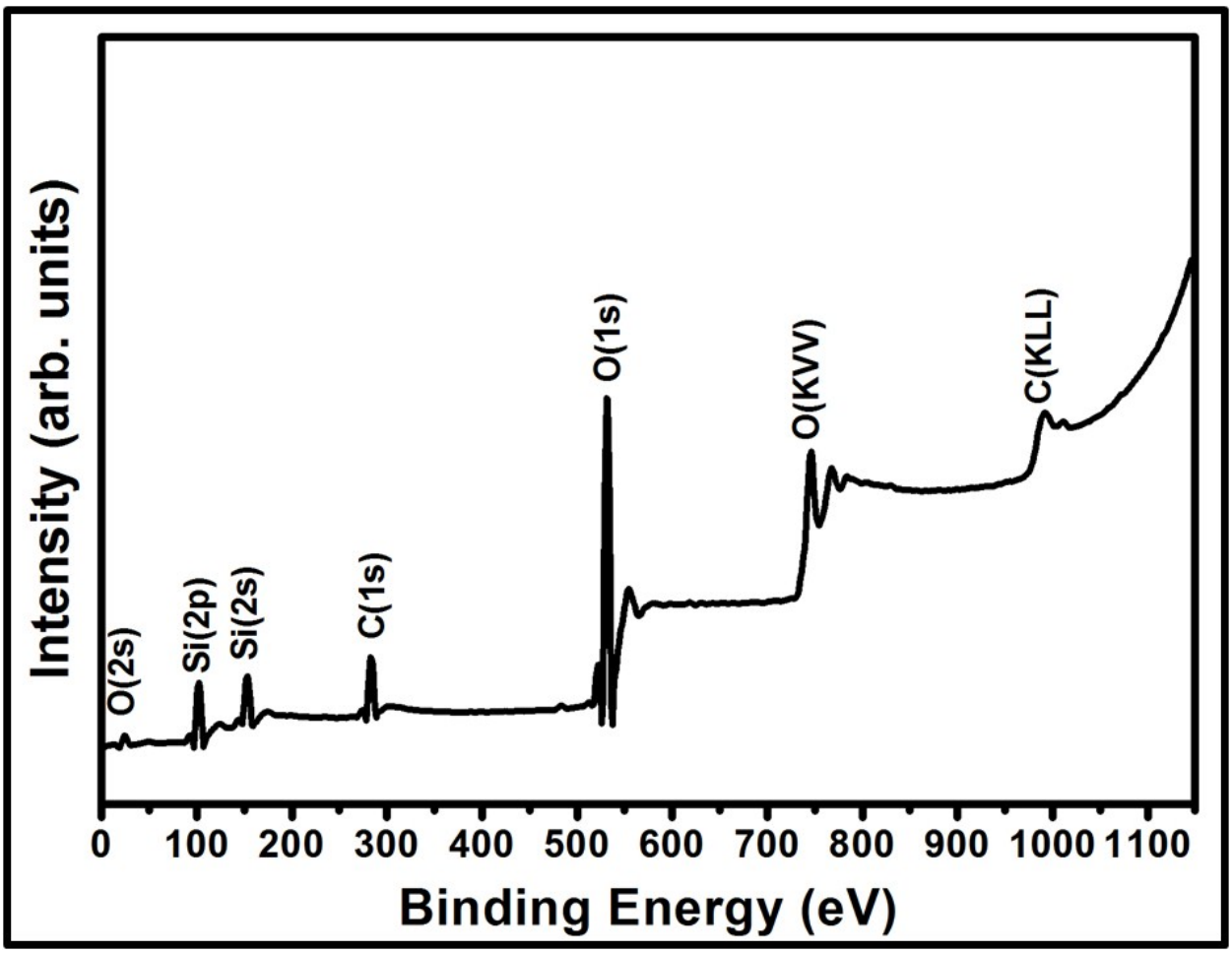


Fig. S7: XPS spectrum of as-synthesized rGO.

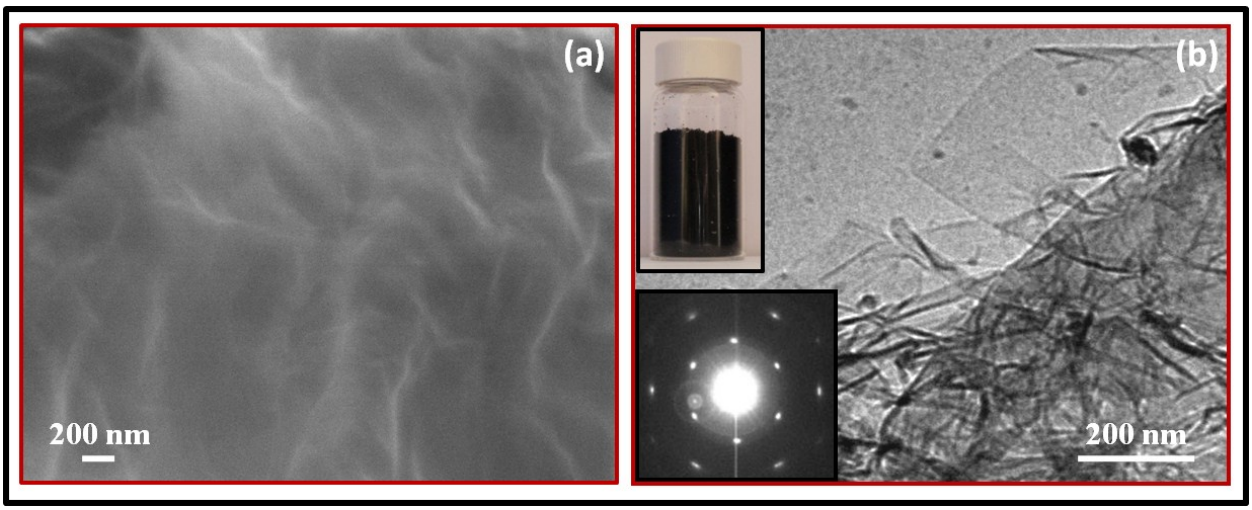
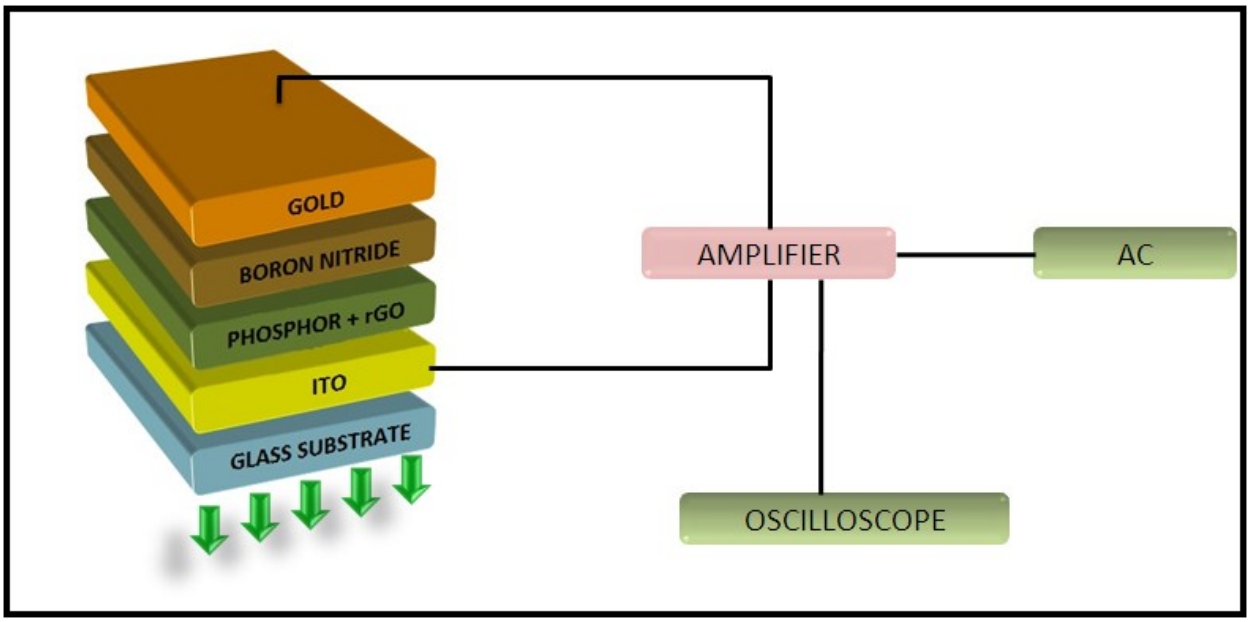


Fig. S8. (a) SEM image of as-synthesized rGO and (b) TEM image of as-synthesized rGO; lower inset part reveals the as-synthesized rGO powder and upper inset shows the SAED pattern of as-synthesized rGO.



Scheme S3. Schematic diagram of EL device composed of ZnS:Cu,Al phosphor and rGO with luminescence measurement setup.

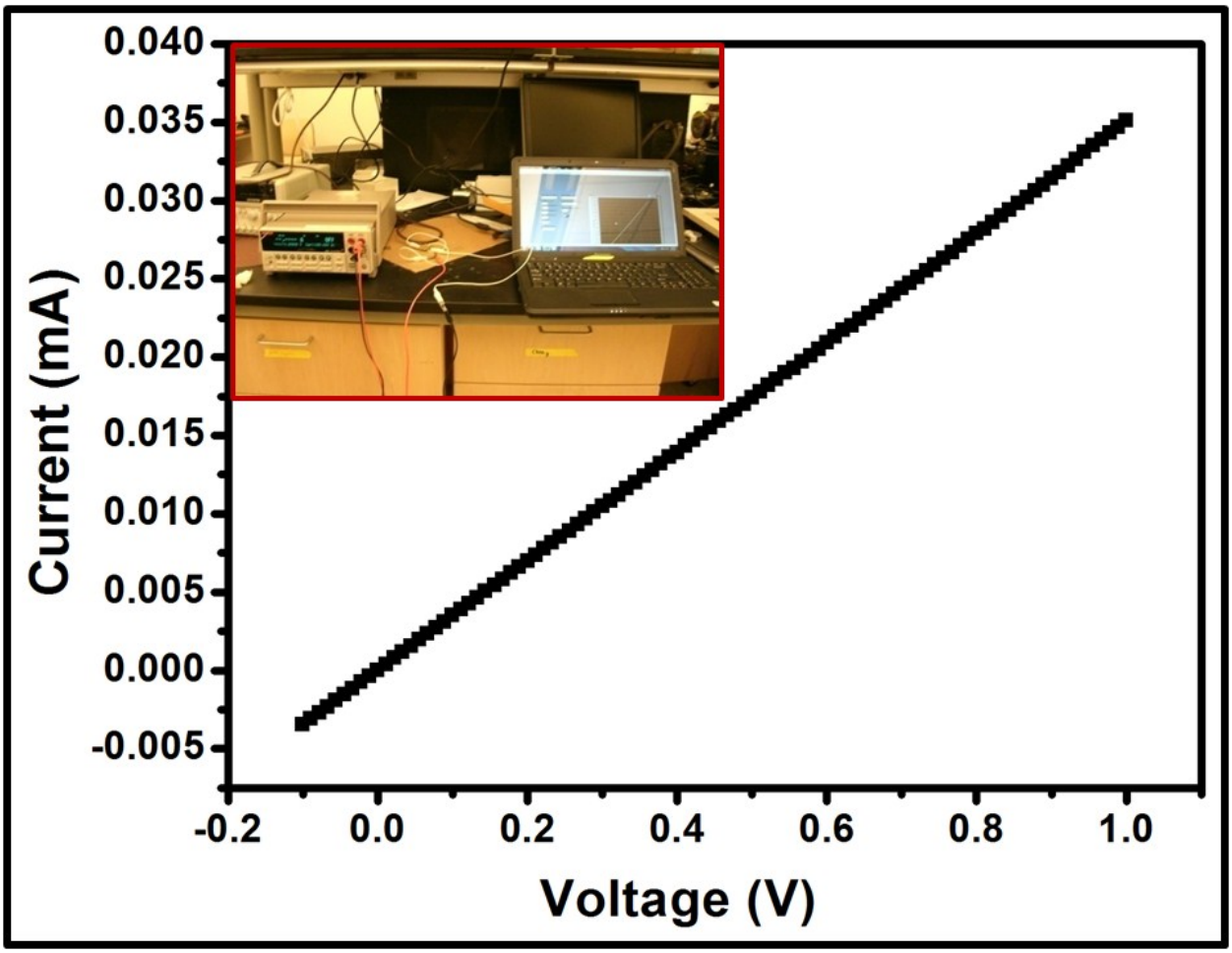


Fig. S9: I-V characteristics of EL device fabricated with ZnS:Cu,Al phosphor and 0.50 wt% rGO and inset shows the measurement setup.

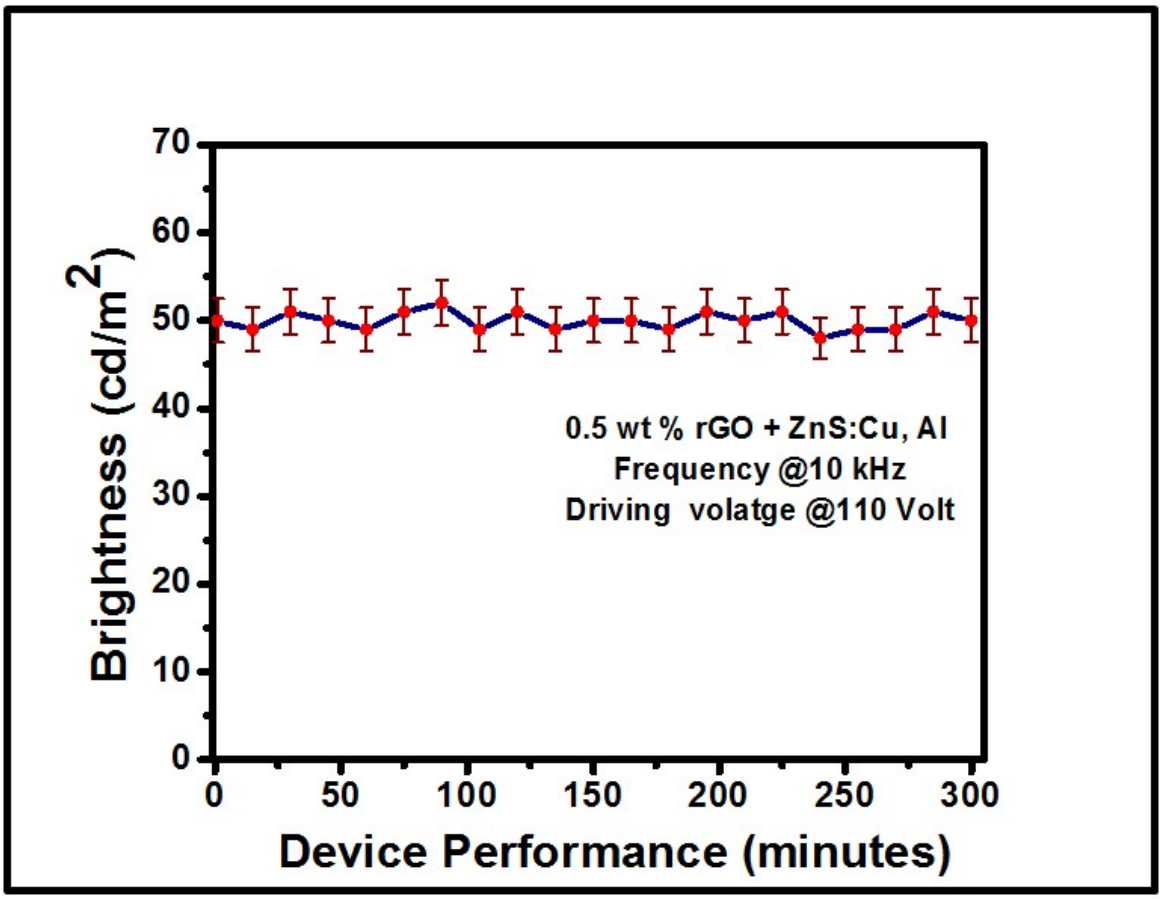


Fig. S10: Stability of the device in air is measured in terms of brightness of the EL devices vs time (minutes) in continuous manner for the device made by ZnS:Cu,Al phosphor composite with 0.5wt% rGO.

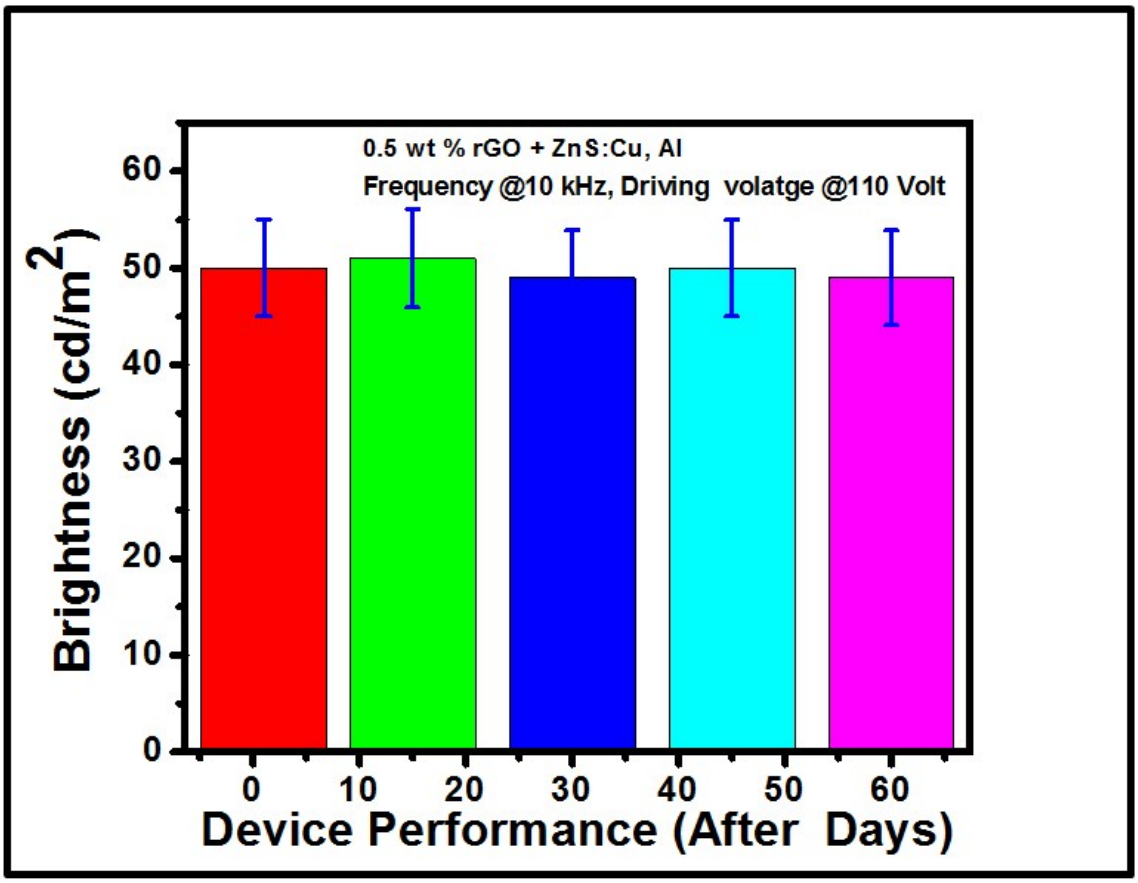


Fig. S11: Stability of the device in air is measured in terms of brightness of the EL devices vs non continuous days for the device made by ZnS:Cu,Al phosphor composite with 0.5wt% rGO to examine the performance after switch ON the device on different days .