Highly transparent and conducting graphene embedded ZnO films with enhanced photoluminescence fabricated by aerosol synthesis

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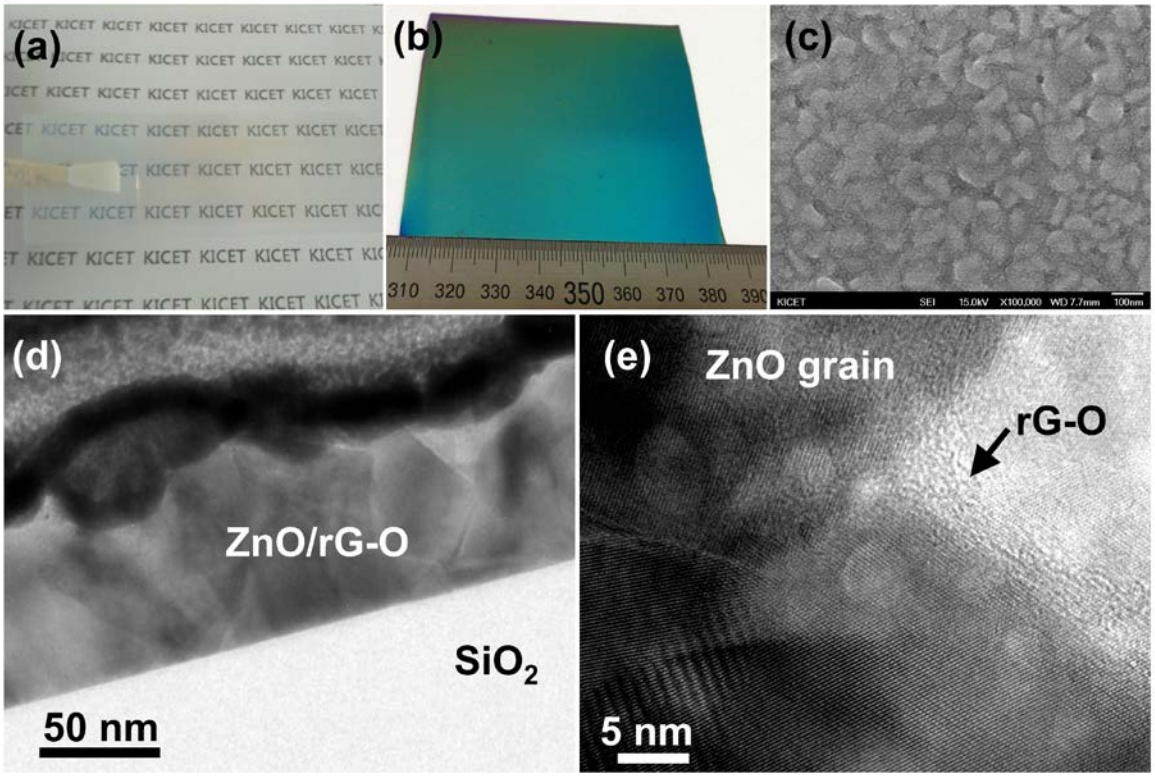
Abstract

Graphene/inorganic hybrid structures have attracted increasing attention in research aimed at advanced optoelectronic devices and sensors. Herein, we report on aerosol synthesis of new graphene-embedded zinc oxide (ZnO) films with high optical transparency (>80 % at visible wavelengths), improved electrical conductivity (>2 orders of magnitude, ~20 kΩ/□), and enhanced photoluminescence (~3 times), compared to those of bare ZnO film. The ZnO/graphene composite films, in which reduced graphene oxide (rG-O) nanoplatelets (~4 nm thick) are embedded in nano-grained ZnO (~50 nm in grain size), were fabricated from colloidal suspensions of graphene oxide with an aqueous zinc precursor. The enhanced photoluminescence is thought to result from the resonant excitation of a graphene plasmon. These new photoluminescent ZnO/graphene composites, with high optical transparency and improved electrical conductivity, are promising materials for use in optoelectronic devices.

References

[1] Jong-Young Kim, Bob Jin Kwon and Sung Jin An, **Nanotechnology**, 25 (2012)

Figures



(a) A transparent ZnO/rG-O composite film on a glass substrate. (b) A large-area (80 mm □ 80 mm) ZnO/rG-O film on a SiO2/Si substrate. (c) A SEM image of ZnO/rG-O (5.0 wt%) by UASP. (d) A bright-field TEM micrograph of the ZnO/rG-O thin film deposited on a thermal oxide layer. (e) An HR-TEM micrograph showing the rG-O thin layer (~4 nm) embedded in nano-grained ZnO.