Electronic Supplementary Information

Rare Earth Free Bright and Persistent White Light Emitting Zinc Gallo-Germanate Nanosheets and Fiber

Bhupendra B. Srivastava[1*], Santosh K. Gupta[2,3], Raul Barbosa[4], Alexa Villarreal[4], Karen Lozano[4*], and Yuanbing Mao[5*]

[1]*Department of Chemistry, University of Texas Rio Grande Valley, 1201 West University Drive, Edinburg, Texas 78539, USA*
[2]*Radiochemistry Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, India*
[3]*Homi Bhabha National Institute, Anushaktinagar, Mumbai, India - 400094*
[4]*Department of Mechanical Engineering, University of Texas Rio Grande Valley, Edinburg, TX 78539, USA*
[5]*Department of Chemistry, Illinois Institute of Technology, 3101 South Dearborn Street, Chicago, IL 60616, USA*

*To whom correspondence should be addressed. bhupendra.srivastava@utrgv.edu (BBS), karen.lozano@utrgv.edu (KL), and ymao17@iit.edu (YM)

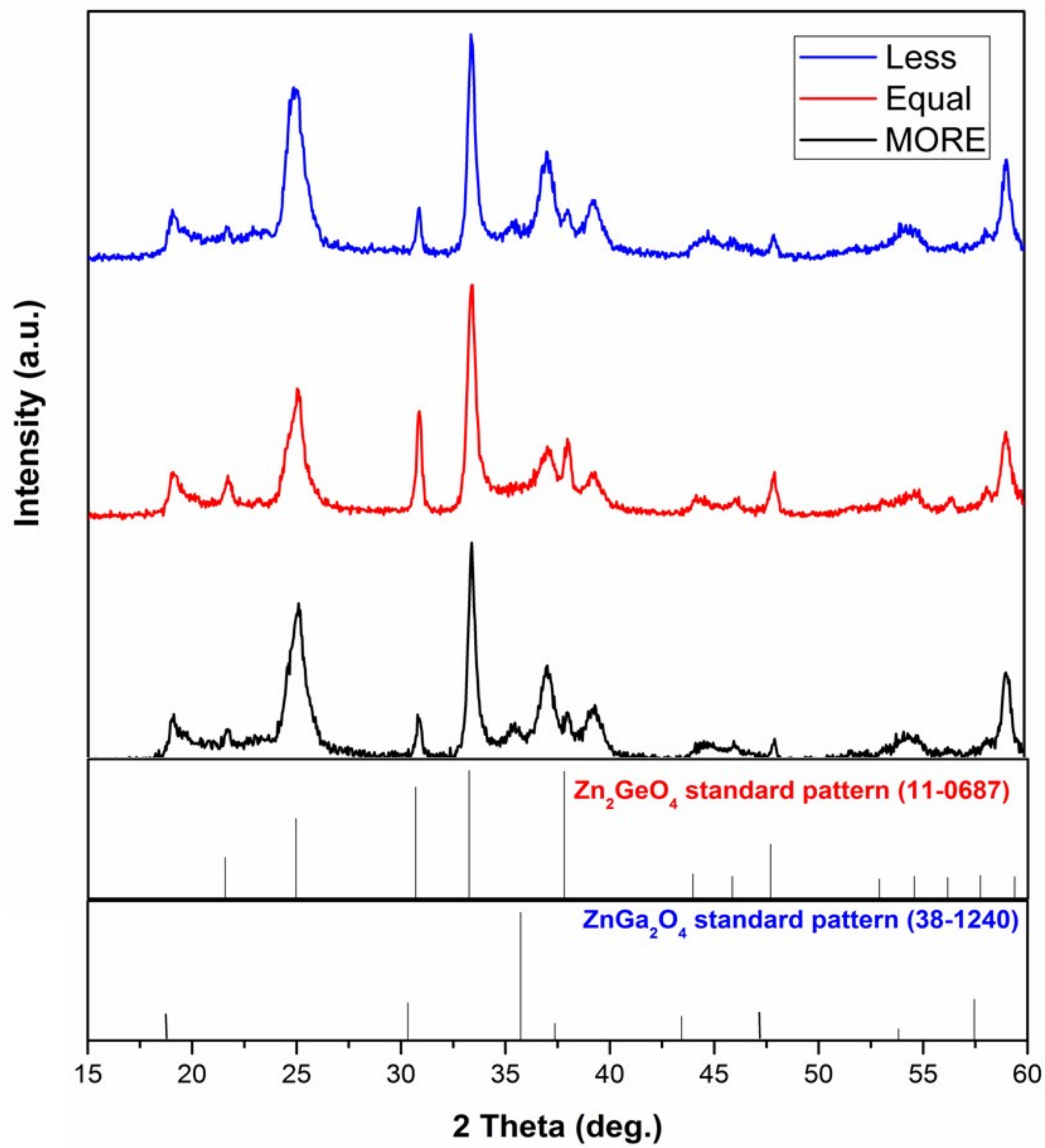

Figure S1. XRD patterns of the ZGG NSs synthesized from different $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2 ratios. "Less" and "More" reflect lower and higher concentrations of GeO_2 precursor with respect to $Ga(NO_3)_3 \cdot xH_2O$ precursor where "Less" has $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2 ratio = 1.5, "More" has $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2 ratio = 0.67, and "Equal" symbolizes the $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2ratio = 1:1. Standard Pattern of ZGO and ZGeO is also attached.

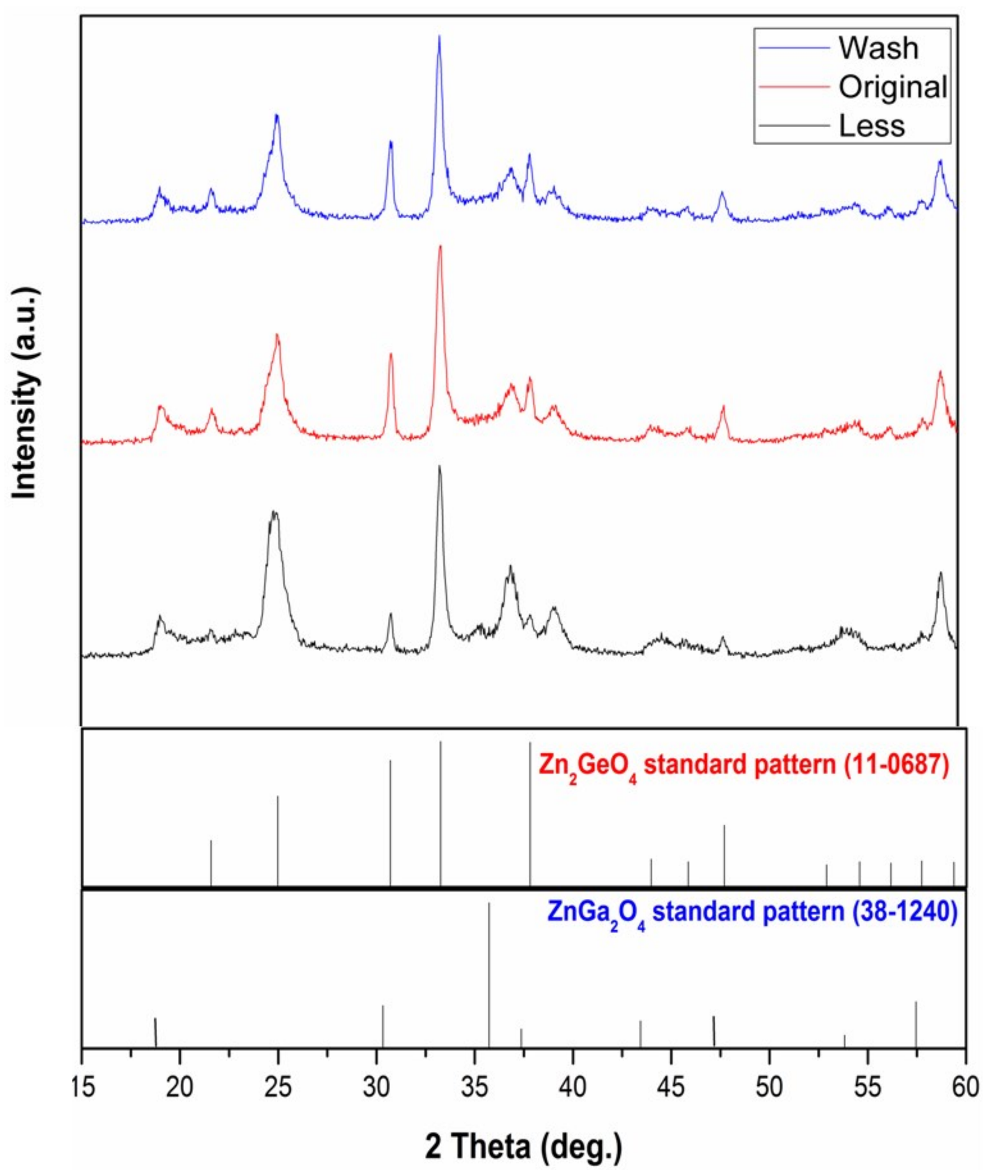

Figure S2. XRD patterns of the hydrothermally synthesized ZGG NSs from two $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2ratios as described in Figure S1 where "Less" has $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2 ratio = 1.5, and "Original" symbolizes the $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2 ratio = 1:1and the as-synthesized ZGG NSs with $Ga(NO_3)_3 \cdot xH_2O$ to GeO_2 ratio = 0.67 after washed with0.1 M NaOH at room temperature for 1 hour to dissolve possible unreacted GeO_2. Standard Pattern of ZGO and ZGeO is also attached.

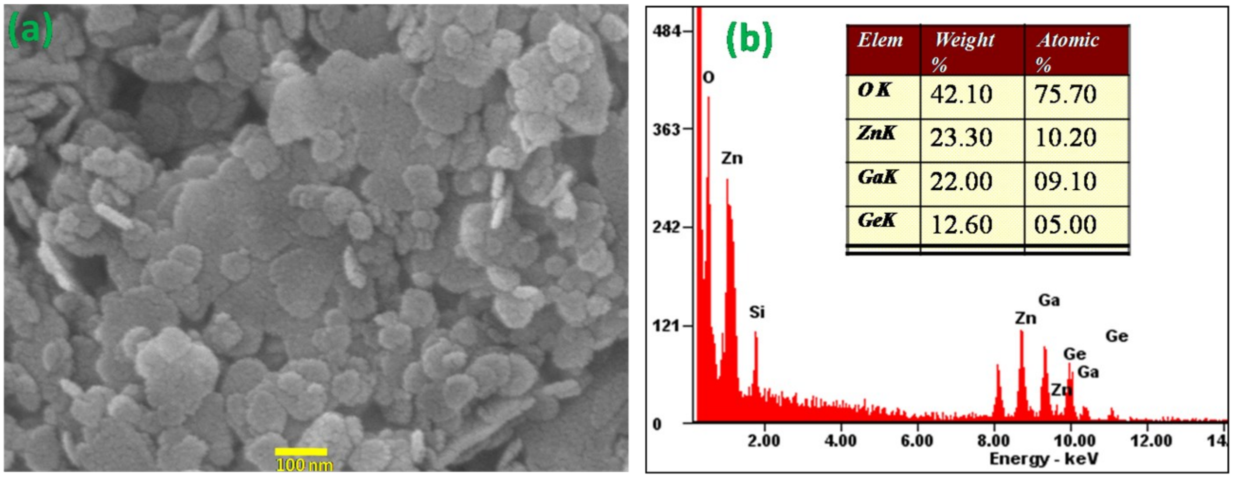

Figure 3. (a) FESEM image and (b) EDX elemental analysis of the as-synthesized ZGG NSs.

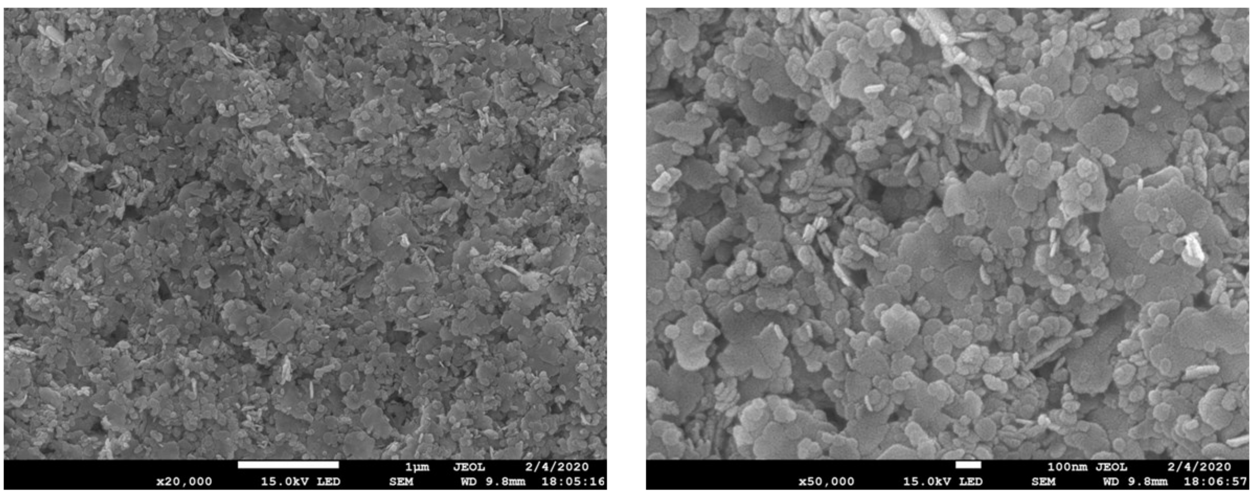

Figure S4. Low magnification SEM images of the as-synthesized ZGG NSs.

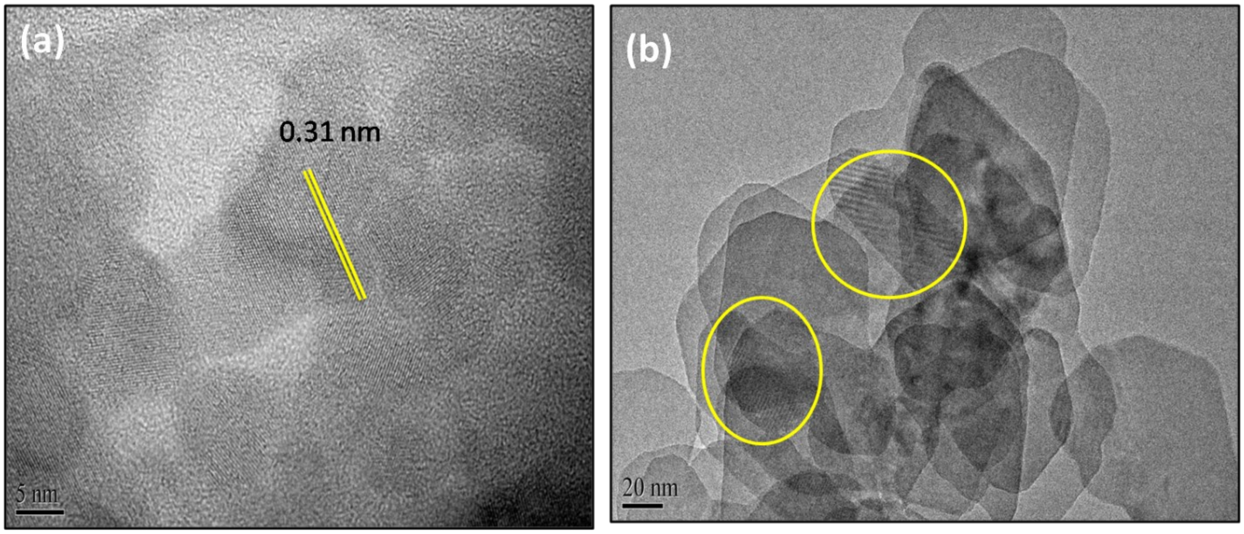

Figure S5. HRTEM images showing (a) lattice fringes with spacing of 0.21 nm and (b) multiple lattice fringes of the as-synthesized ZGG NSs.

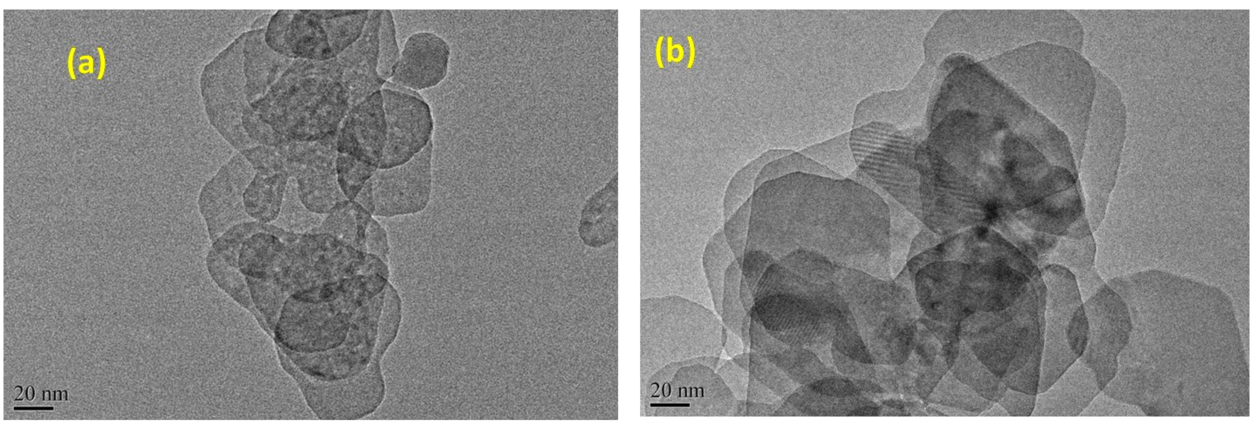

Figure S6. HRTEM images of the ZGG-750 NSs.

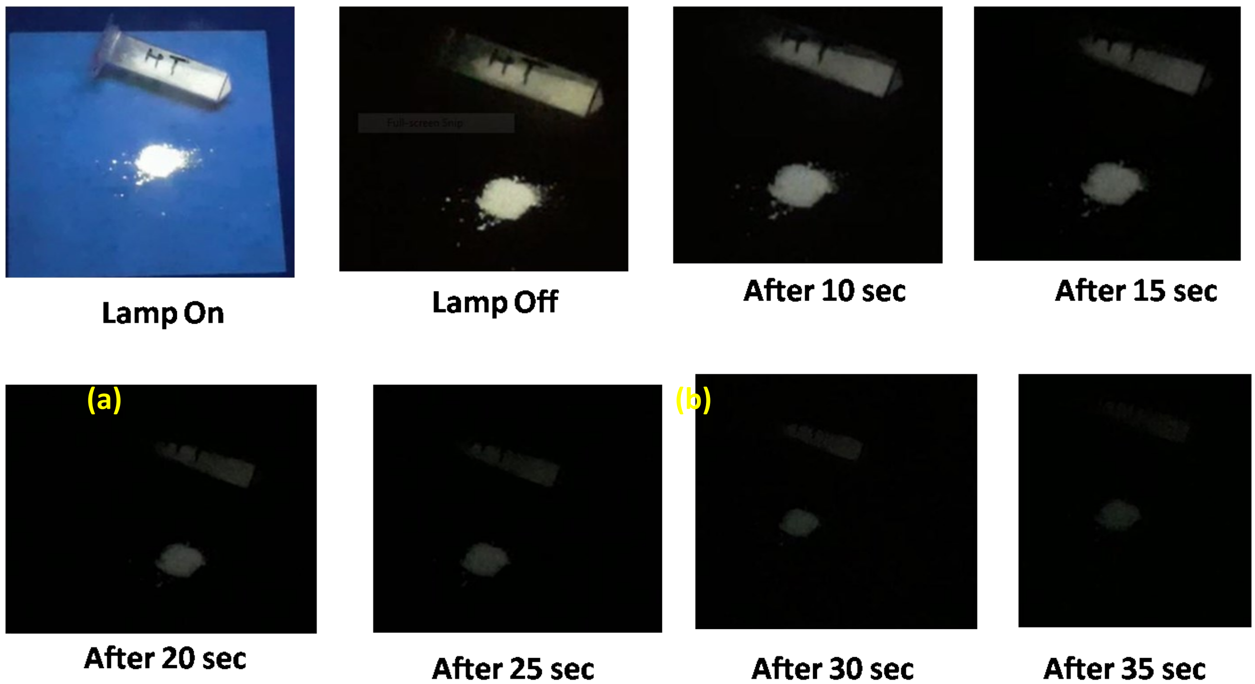

Figure S7: Digital image from ZGG -750 NSs at different time interval

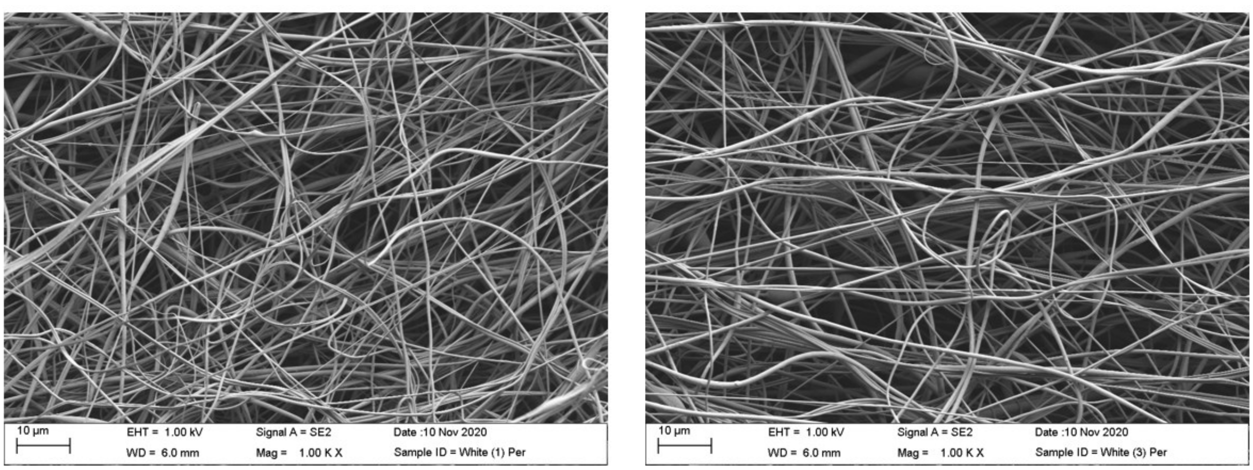

Figure S8. FESEM images of the ZGG-PVA fine fibers with (a) 0.3 wt% and (b) 0.5 wt% loadings of the as-synthesized ZGG NSs.

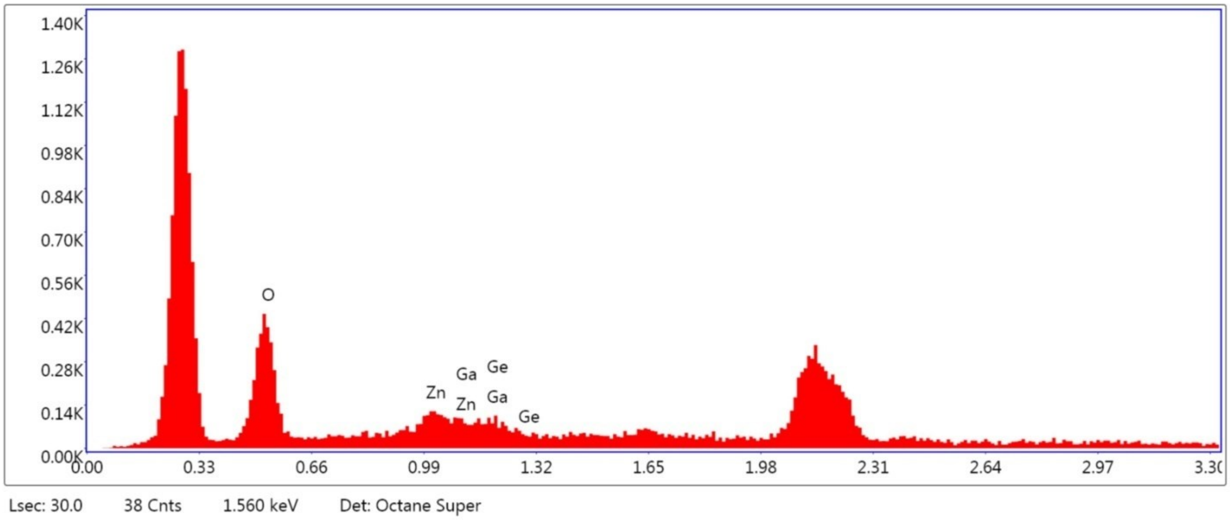

Figure S9. EDX elemental analysis of the ZGG-PVA fine fibers with 1.0 wt% loading the as-synthesized ZGG NSs.

Information S1:

The chromaticity coordinates were evaluated adopting standard procedures as lay down by CIE. In general, the color of any light source can be represented as an (*x*, *y*) coordinate in the CIE color space. The chromatic coordinates (*x*, *y*) can be calculated as follows:

x= X/X+Y+Z and y= Y/X+Y+Z

Where X=$\int \bar{x}(\lambda)s(\lambda)d\lambda$, Y=$\int \bar{y}(\lambda)s(\lambda)d\lambda$ and X=$\int \bar{z}(\lambda)s(\lambda)d\lambda$. Here $\bar{x}(\lambda), \bar{y}(\lambda)\ and\ \bar{z}(\lambda)$ are the CIE *x*, *y*, and *z* color matching functions, respectively. $s(\lambda)$ is the spectrum of a light source. The dominant wavelength is defined as the single monochromatic wavelength that appears to be having same color as the light source. The dominant wavelength can be determined by drawing a straight line from one of the CIE white illuminants, through the (*x*, *y*) coordinates to be measured, until the line intersects the outer locus of points along the spectral edge of the 1931 CIE chromatic diagram. The dominant wavelength is the wavelength of the intercept of the straight line and the outer edge of the space.