

## *Supplementary Materials*

# Highly Efficient and Sustainable ZnO/CuO/g-C<sub>3</sub>N<sub>4</sub> Photocatalyst for Wastewater Treatment under Visible Light through Heterojunction Development

Md. Abu Hanif <sup>1\*</sup>, Jeasmin Akter<sup>3</sup>, Young-Soon Kim<sup>1</sup>, Hong Gun Kim<sup>1,2</sup>, Jae Ryang Hahn<sup>3</sup>, Lee Ku Kwac<sup>1,2,\*</sup>

<sup>1</sup> Institute of Carbon Technology, Jeonju University, Jeonju 55069, Korea; [hanif4572@gmail.com](mailto:hanif4572@gmail.com); [kyscb@jj.ac.kr](mailto:kyscb@jj.ac.kr)

<sup>2</sup> Graduate School of Carbon Convergence Engineering, Jeonju University, Jeonju 55069, Korea; [hkim@jj.ac.kr](mailto:hkim@jj.ac.kr); [kwac29@jj.ac.kr](mailto:kwac29@jj.ac.kr)

<sup>3</sup> Department of Chemistry and Research Institute of Physics and Chemistry, Jeonbuk National University, Jeonju 54896, Korea; [tina44445@gmail.com](mailto:tina44445@gmail.com); [jrhahn@jbnu.ac.kr](mailto:jrhahn@jbnu.ac.kr)

\* Correspondence: [hanif4572@gmail.com](mailto:hanif4572@gmail.com) (M.A.H.); [kwac29@jj.ac.kr](mailto:kwac29@jj.ac.kr) (L.K.K.); Tel.: +82-63-220-3157 (M.A.H.); +82-63-220-3063 (L.K.K.)

### Calculation of Crystallite size

The crystallite size of the CuO-NPs, ZnO-NPs, and ZCG nanocomposite was calculated by using the modified Scherrer equation and the corresponding curves were shown in Figure S1. The calculated crystallite size of the CuO-NPs, ZnO-NPs, and ZCG nanocomposite was 27.01, 26.45, and 25.32 nm, respectively. The detailed calculation process is given below:

We know the well-known Scherrer equation is:

$$D = k\lambda/\beta\cos\theta \quad (S1)$$

where, D refers to crystallite size, k denotes non-dimensional shape factor (0.94),  $\beta$  is the full width at half maximum,  $\lambda$  is the X-ray wavelength (0.15406), and  $\theta$  is the Bragg angle.

After adding  $\log(\ln)$  on both sides of the above equation, we can write as follows:

$$\ln \beta = \ln \{(1/\cos\theta) \times (k\lambda/D)\} \quad (S2)$$

This equation is known as Modified Scherrer Equation (MSE). From the plot of  $\ln (1/\cos\theta)$  on the x-axis and  $\ln \beta$  on the y-axis, we can calculate the crystallite size from the y-intercept value  $[\ln (k\lambda/D)]$ .

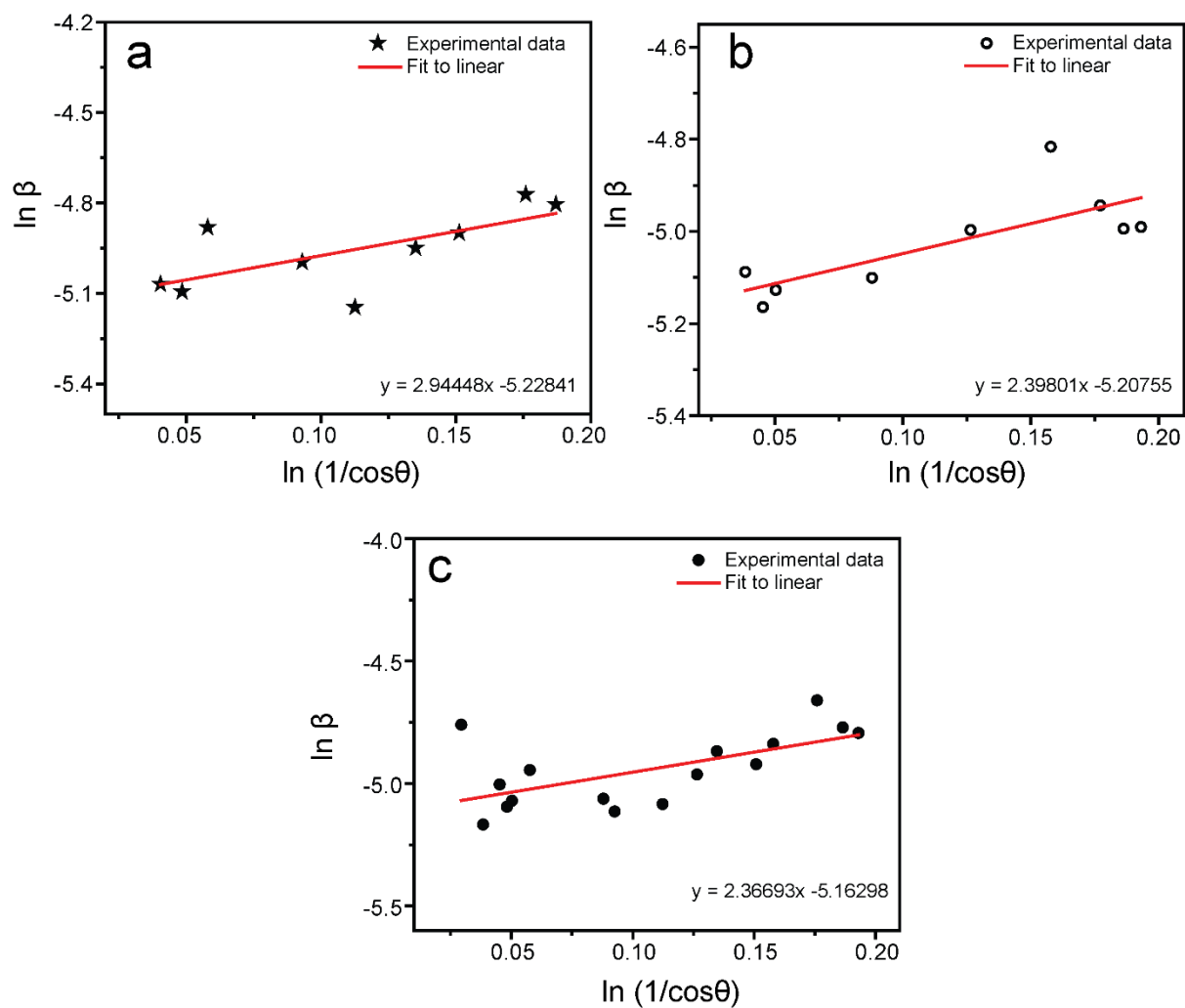
For example, the D of CuO-NPs is given below:

$$\text{y-intercept} = -5.22841 = \ln (k\lambda/D) \quad (S3)$$

$$e^{-5.22841} = e^{\ln (k\lambda/D)} \quad (S4)$$

$$0.005362 = (k\lambda/D) \quad (S5)$$

Therefore,  $D = 27.01 \text{ nm}$



**Figure S1.** Linear plots of modified Scherrer equation (a) CuO-NPs, (b) ZnO-NPs, and (c) ZCG nanocomposite.