

Supplementary information: 1. Video of LED (2.5 V) glow for 132 seconds and charge only 2 seconds 2. Calculation form Galvanostatic charge-discharge cycles

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1. Video of LED (2.5 V) glow for 132 seconds and charge only 2 seconds



LED_Glow_videio.mp4

2. Calculation form Galvanostatic charge-discharge cycles

Calculation of GO/ZnO/Cellulose Composite from Galvanostatic Charge Discharge cycles:

Current $I=10\text{mA}$

Mass= 80mg

$\Delta V = 1\text{V}$

Discharge time $\Delta t = 300\text{sec}$

$$C_p = \frac{I\Delta t}{m\Delta V}$$

$$C_p = \frac{10 \times 10^{-3} \times 300}{80 \times 10^{-3} \times 1}$$

$$C_p = 37.5 \frac{\text{F}}{\text{g}}$$

Energy Density:

$$E_g = \frac{C_p(\Delta V)^2}{2}$$

$$E_g = \frac{37.5(1)^2 \times 10^3}{2}$$

$$E_g = 18750 \frac{\text{J}}{\text{kg}}$$

$$E_g = 5.2 \frac{\text{Wh}}{\text{kg}}$$

Calculation of ZnO/Cellulose Composite:

$$\text{Current } I = 100 \mu\text{A}$$

$$\text{Mass} = 59 \text{mg}$$

$$\Delta V = 0.2 \text{V}$$

$$\Delta t = 14 \text{sec}$$

$$C_p = \frac{I \Delta t}{m \Delta V}$$

$$C_p = \frac{100 \times 10^{-6} \times 14}{59 \times 10^{-3} \times 0.2}$$

$$C_p = 0.118 \frac{\text{F}}{\text{g}}$$

Energy Density :

$$E_g = \frac{C_p (\Delta V)^2}{2}$$

$$E_g = \frac{0.118 (0.2)^2 \times 10^3}{2}$$

$$E_g = 2.36 \frac{\text{J}}{\text{kg}}$$

$$E_g = 6.6 \times 10^{-4} \frac{\text{Wh}}{\text{kg}}$$