Electronic supplementary information (ESI):

Just after addition of NaOH + Ammonium Persulphate | **After 10 min.** | **After 4h** | **After 20h**

Fig.S1: Colour change of the mixture during formation process at different time of reaction time.

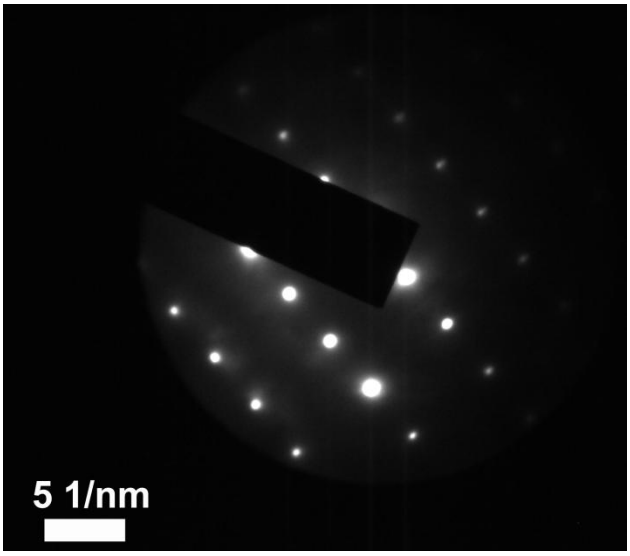

Fig.S2: SAED pattern corresponding to ZnO nanowire

Growth mechanism of CuO nanostructures:

During addition of $NaOH + ((NH_4)_2 S_2 O_8)$ mixture to the copper powder, copper hydroxide formed as an intermediate over the copper metal core following the reaction

$$Cu + NaOH \rightarrow Cu(OH)_2 + Na^+$$

It is well known that hydroxide of copper bears a layer structure, thus oxidation of the layer structure by the strong oxidant ammonium persulphate gives rise to sheetlike CuO structure where copper hydroxide layered structure acts both as the precursor and the template.

The oxidation process follows the reaction

$$Cu(OH)_2 + Na^+ + (NH_4)_2 S_2 O_8 \rightarrow CuO + Na_2 SO_4 + (NH_4)_2 SO_4 + H_2 O$$

We have also observed this type of self templating effect of layered hydroxide structure for the case of zinc oxide previously.[U.N. Maiti, S. Karan, B. Mallik, K.K. Chattopadhyay, Synthesis of a zinc oxide nanosheet–nanowire network complex by a low-temperature chemical route: Efficient UV detection and field emission property. Scripta Materialia 62 (2010) 305.]

Fig.S3: (a) Digital image of the decolouration of RhB solution after different time of UV exposure from left to right 0, 20, 40, 60, 80, 100, 120 min. respectively.

(b) Digital image of the decolouration of orange II dye after different time of UV exposure from left to right 0, 10, 20, 30, 40, 45 min. respectively.

Experimental condition for CuO **visible photocatalysis test:** Photocatalytic activity of the synthesized CuO nanostructures was evaluated with RhB (Aldrich) dye under visible light irradiation from 350 W xenon lamp equipped with a 420 nm cutoff filter. $30mg$ of the CuO sample was dispersed within $30ml$ dye solution (RhB) with concentration of $10^{-5}M$ in $100ml$ quartz beaker together with 0.2 ml H_2O_2 and the light source to sample distance kept at 10 cm. rest of the measurement procedure is similar to that employed for ZnO nanostructure as mentioned in the main text.

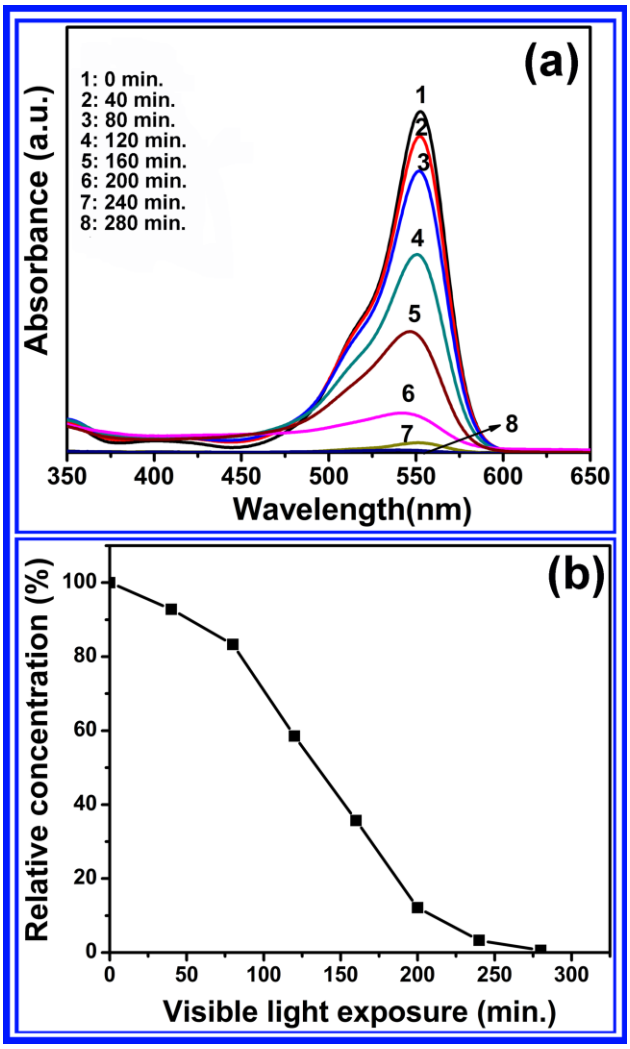

Fig.S4: (a) Temporal evolution of UV-Vis absorption spectra corresponding to RhB for *CuO* nanostructures (b) Corresponding decrease of relative concentration of dye after different time of visible light exposure.