Supporting Information for

High-efficiency actuator with great photoinduced force based on a bioinspired gradient design

Mingxia Liu, Zhao Xu, Yimei Lv, Shu Zhu, Weiping Liu, Lili Yang*, Dengteng Ge*

This PDF includes:

Theoretical calculation of gradient actuator

Fig. S1 to Fig. S4

Legends for Video S1 to Video S4

Theoretical calculation for gradient actuator

Upon lights irradiation on the top surface of film, the light intensity of absorption for the first layer is:

$$I_{abs,1} = A_1 \cdot I_0 \tag{S1}$$

where I_0 indicates the incident light intensity. Thus the light intensity of absorption for the second layer is:

$$I_{abs,2} = (1\text{-}A_1) \cdot A_2 \cdot I_0 \tag{S2}$$

Accordingly, the light absorption intensity of the n^{th} layer is:

$$I_{abs,n} = (1\text{-}A_1)\cdot(1\text{-}A_2)\ldots(1\text{-}A_{n\text{-}1}) \cdot A_n \cdot I_0 \tag{S3}$$

In order to achieve a uniform temperature distribution along the thickness direction, the light absorption of each layer should be consistent. Thus,

$$I_{abs,1} = I_{abs,2} = \ldots = I_{abs,n} \tag{S4}$$

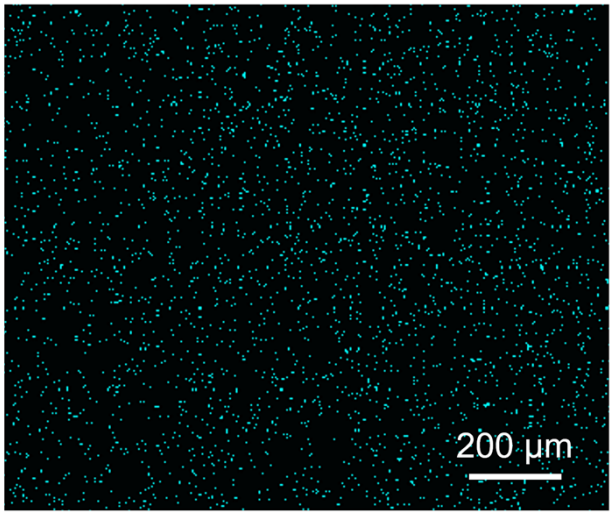

Fig. S1 EDS pattern of silver in the sectional composite

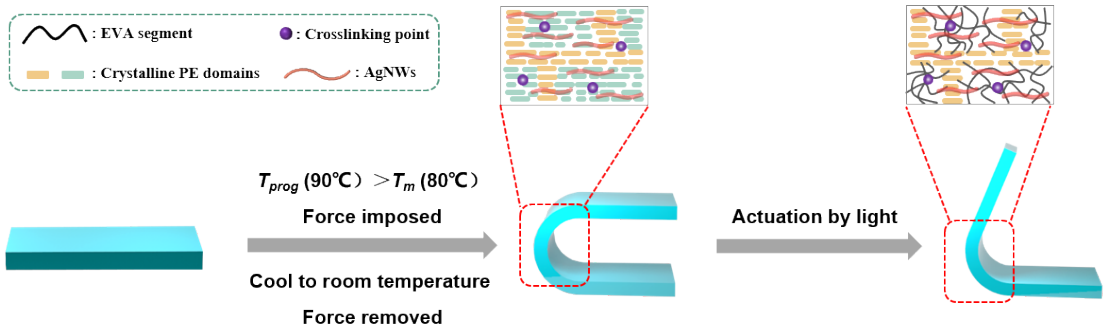

Fig. S2 Schematic illustration of AgNW/EVA composites showing their programing and morphing mechanism. Orange arrays represent the skeleton domain formed by crystallites of $T_{m,high}$. Blue arrays represent the actuation domain formed by crystallites of $T_{m,low}$.

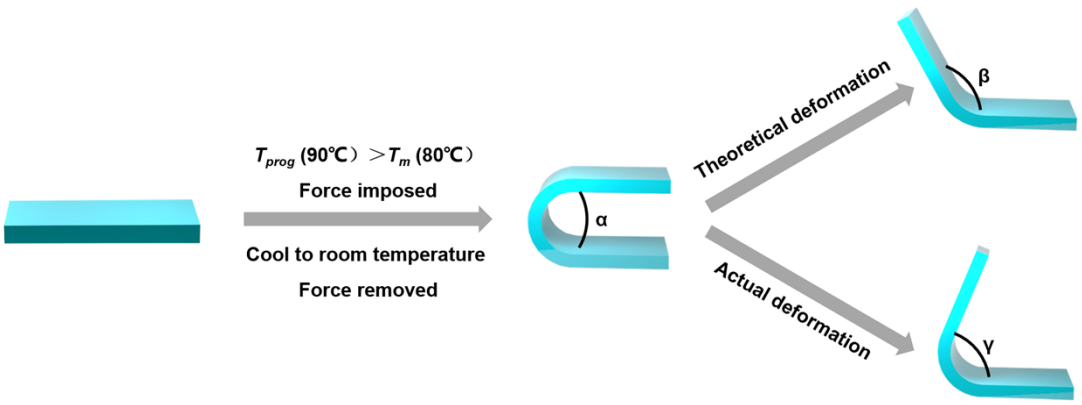

Fig. S3 Illustration for the calculation of deformation accuracy

The deformation accuracy can be calculated by:

$$A_d = \frac{\gamma - \alpha}{\beta - \alpha}$$

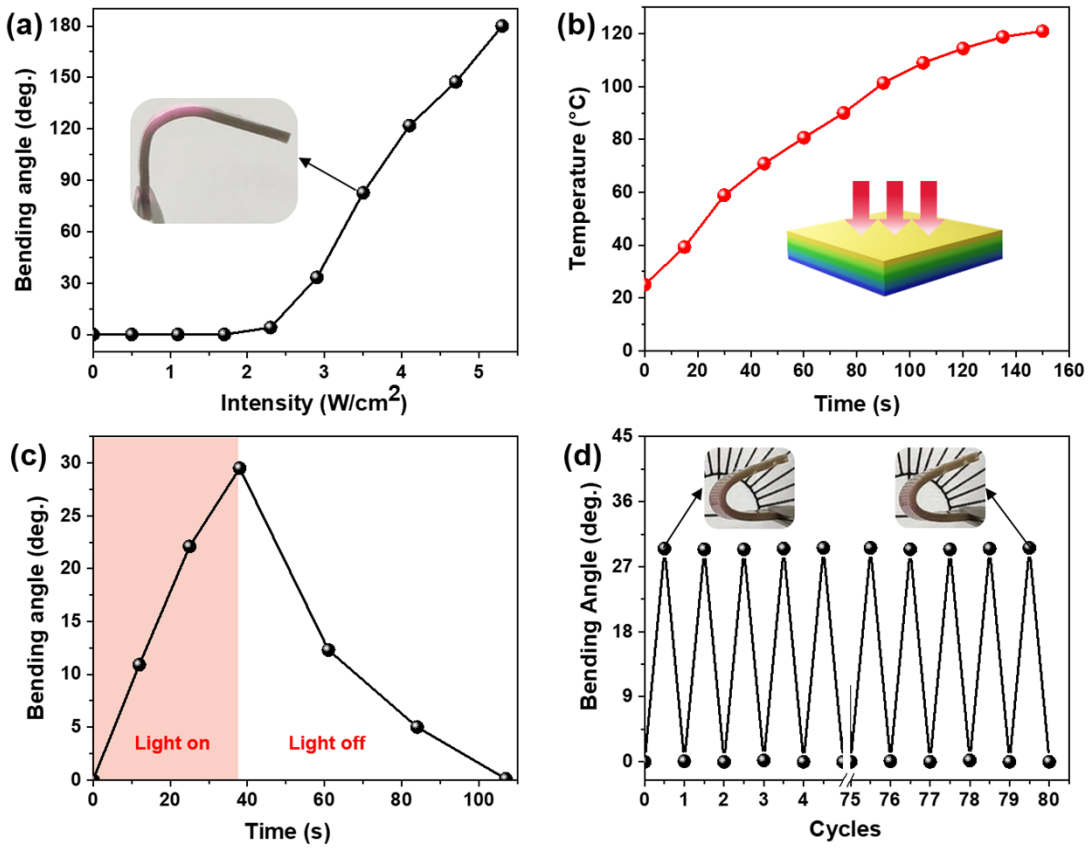

Fig. S4 (a) The bending angles of gradient AgNW/EVA composites (1.3 mm) under different light intensity at 808 nm for 5 s. (b) Temperature change with time of gradient AgNW/EVA composites under the irradiation intensity of 1.2 W·cm^{-2}. (c) Angle changes of AgNW/EVA with time upon turning on and off NIR light (808 nm, 1.2 W·cm^{-2}). (d) Deformation stability of gradient composites.

Description of Supplemental Video

Video S1 Deformation process of actuator

Video S2 Gradient actuator used as circuit switches

Video S3 Homogeneous actuator used as circuit switches

Video S4 The thick and thin gradient actuators imitating the movement of "Double Dragon Playing Ball"