Electronic Supplementary Information (ESI)

Flexible Janus Nanoribbons to Help Obtain Simultaneous Color-Tunable Enhanced Photoluminescence, Magnetism and Electrical Conduction Trifunctionality

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Preparation of Fe_3O_4 NPs

Fe_3O_4 NPs were obtained *via* a facile coprecipitation synthetic method, and PEG was used as the protective agent to prevent the particles from aggregation. One typical synthetic procedure was as follows: 5.4060 g of $FeCl_3 \cdot 6H_2O$, 2.7800 g of $FeSO_4 \cdot 7H_2O$, 4.0400 g of NH_4NO_3 and 1.9000 g of PEG were added into 100 mL of deionized water to form uniform solution under vigorous stirring 50 °C. To prevent the oxidation of Fe^{2+}, the reactive mixture was kept under argon atmosphere. After the mixture had been bubbled with argon for 30 min, 0.1 $mol \cdot L^{-1}$ of $NH_3 \cdot H_2O$ was dropwise added into the mixture to adjust the pH value above 11. Then the system was continuously bubbled with argon for 20 min at 50 °C, and black precipitates were formed. The precipitates were collected from the solution by magnetic separation, washed with deionized water for three times, and then dried in an electric vacuum oven for 12 h at 60 °C.

Synthesis of $Tb(BA)_3$phen and $Eu(BA)_3$phen complexes

$Tb(BA)_3$phen powder was synthesized according to the traditional method as described in the reference[35]. 1.8691 g of Tb_4O_7 was dissolved in 10 mL of concentrated nitric acid and then crystallized by evaporation of excess nitric acid, and $Tb(NO_3)_3 \cdot 6H_2O$ was acquired. $Tb(NO_3)_3$ ethanol solution was prepared by adding 10 mL of anhydrous ethanol into the above $Tb(NO_3)_3 \cdot 6H_2O$. 3.6636 g of BA and 1.9822 g of phen were dissolved in 100 mL of ethanol. The $Tb(NO_3)_3$ solution was then

added into the mixture solution of BA and phen with magnetic agitation for 3 h at 60 °C. The precipitate was collected by filtration and dried for 12 h at 60 °C. The synthetic method of $Eu(BA)_3phen$ complexes was similar to the above method, except that the using dosages of Eu_2O_3, BA and phen were 1.7596 g, 3.6636 g and 1.9822 g, respectively.

Preparation of PMMA

0.1000 g of BPO and 100 mL of MMA were added into a 250-mL three-necked flask with a backflow device and stirred vigorously at 90-95 °C. When the viscosity of the mixture solution reached up to a certain value just like that of glycerol, the heating was stopped and the mixture was naturally cooled to room temperature. The obtained gelatinous solution was loaded into test tubes, and the influx height was 5-7 cm. Then the tubes were put in an electric vacuum oven at 50 °C for 48 h, and the gelatinous solution was solidified. Finally, the temperature was raised to 110 °C for 2 h to terminate the reaction in the oven[36].

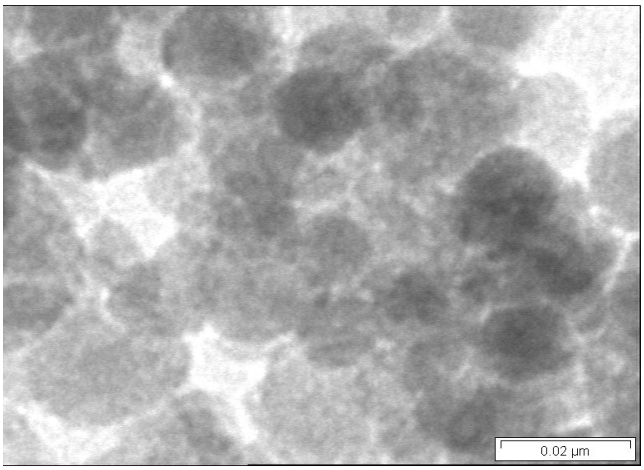

Figure S1 TEM image of Fe_3O_4 NPs

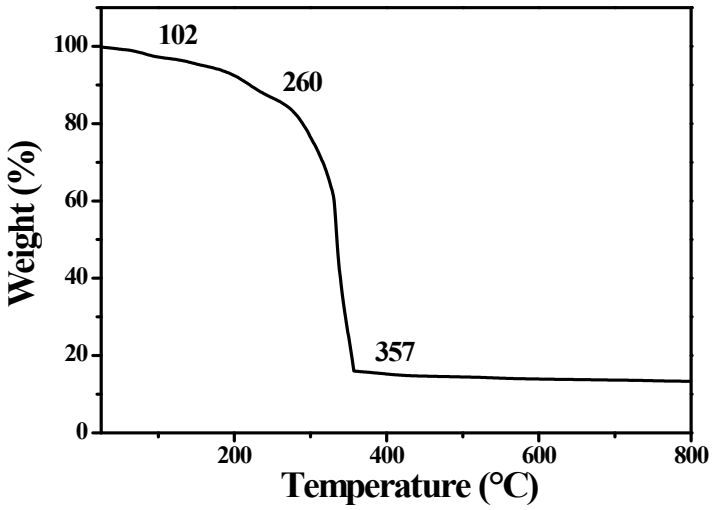

Figure S2 TG curve of {[50%$Eu(BA)_3phen$+50%$Tb(BA)_3phen$]/PMMA}//[PANI/Fe_3O_4/PMMA] Janus nanoribbons

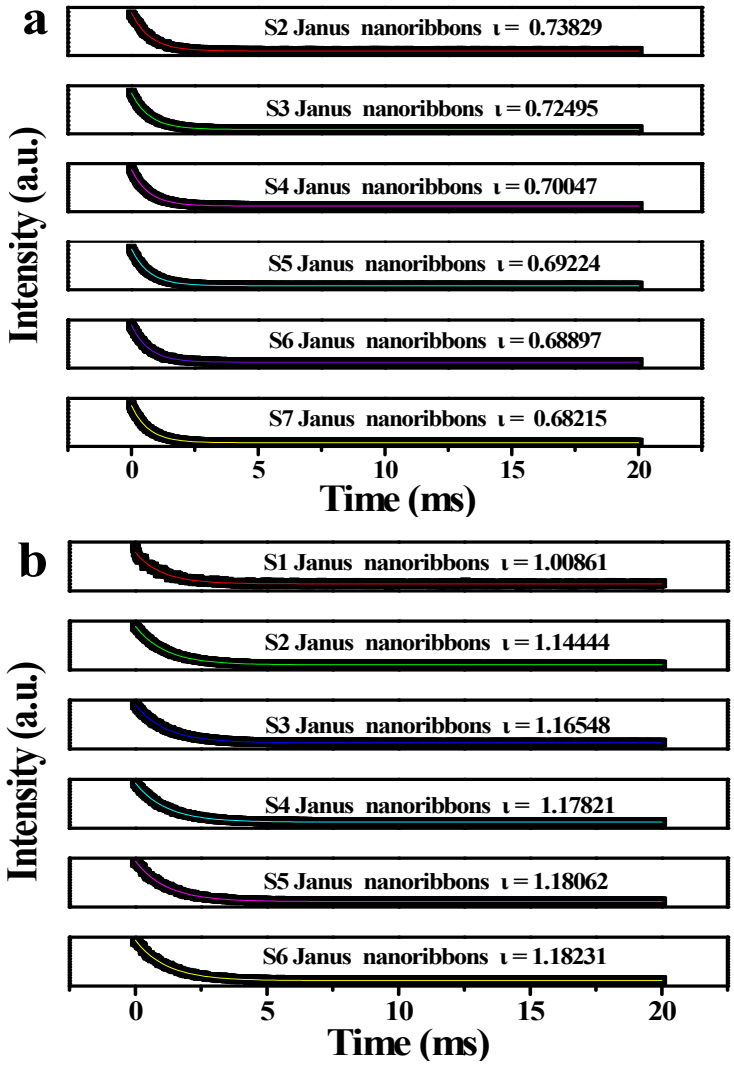

Figure S3 Fluorescence decay dynamics of the $^5D_4 \rightarrow {}^7F_5$ transitions (λ_{em} = 545 nm, a) and $^5D_0 \rightarrow {}^7F_2$ transitions (λ_{em} = 616 nm, b) in {[Eu(BA)$_3$phen+Tb(BA)$_3$phen]/PMMA}//[PANI/Fe_3O_4/PMMA] Janus nanoribbons doped with different mass ratios of Eu(BA)$_3$phen to Tb(BA)$_3$phen

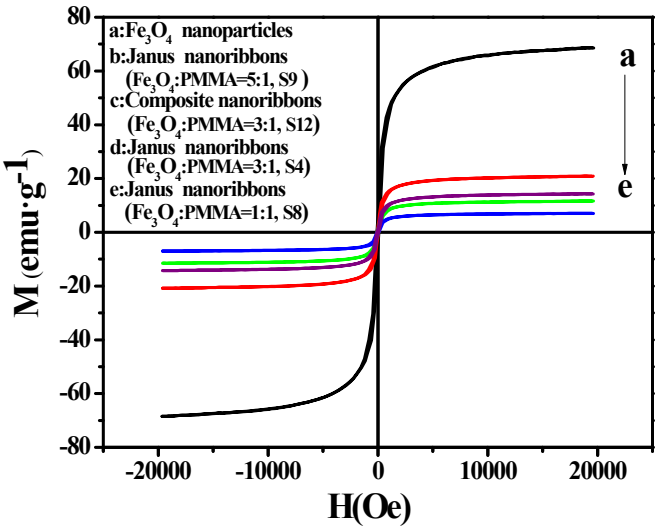

Figure S4 Hysteresis loops of the Fe_3O_4 NPs (a), Janus nanoribbons containing different mass ratios of Fe_3O_4: PMMA as 5:1(b), 3:1(d), and 1:1 (e) and composite nanoribbons with Fe_3O_4 to PMMA as 3:1 (c)