Electronic Supplementary Material (ESI) for RSC Advances

Supporting Information

1 Physical measurements

Fourier transform infrared spectra (FTIR) are measured within KBr slices from 4000-400 cm^{-1} using a Nexus 912 AO446 infrared spectrum radiometer. X-ray powder diffraction patterns (XRD) are acquired on Rigaku D/max-Rb diffractometer equipped with Cu anode; the data are collected within the 2θ range of 10^{o}-70^{o}. Luminescence excitation and emission spectra are measured on a RF-5301 fluorescence photometer. Luminescence lifetimes (τ) are examined by an Edinburgh Instruments FLS 920 phosphormeter. Scanning electronic microscope (SEM) images are obtained with a Hitachi S-4800. The diffuse reflectance UV-Vis spectra of the powdered samples are recorded by a BWS003 spectrophotometer. The NMR spectra were recorded in deuterated solvents on Bruker ARX400. Thermogravimetric analysis (TG) is measure using a Netzsch STA 449C system at a heating rate of 5 °C/min under the nitrogen protection.

XPS experiments were carried out on a RBD upgraded PHI-5000C ESCA system (Perkin Elmer) with Mg Kα radiation (hν = 1253.6 eV) or Al Kα radiation (hν = 1486.6 eV). In general, the X-ray anode was run at 250W and the high voltage was kept at 14.0 kV with a detection angle at 54°. The pass energy was fixed at 23.5, 46.95 or 93.90 eV to ensure sufficient resolution and sensitivity. The base pressure of the analyzer chamber was about 5×10^{-8} Pa. The sample was directly pressed to a self-supported disk (10×10 mm) and mounted on a sample holder then transferred into the analyzer chamber. The whole spectra (0~1100 (1200)eV) and the narrow spectra of all the elements with much high resolution were both recorded by using RBD 147 interface (RBD Enterprises, USA) through the AugerScan 3.21 software. Binding energies were calibrated by using the containment carbon (C1s = 284.6eV). The data analysis was carried out by using the RBD AugerScan 3.21 software provided by RBD Enterprises.

Fig. S1 X-ray Diffraction (XRD) patterns for the pure GaN and GaN-IM^{+}-[Eu(TTA)$_4$]$^{-}$.

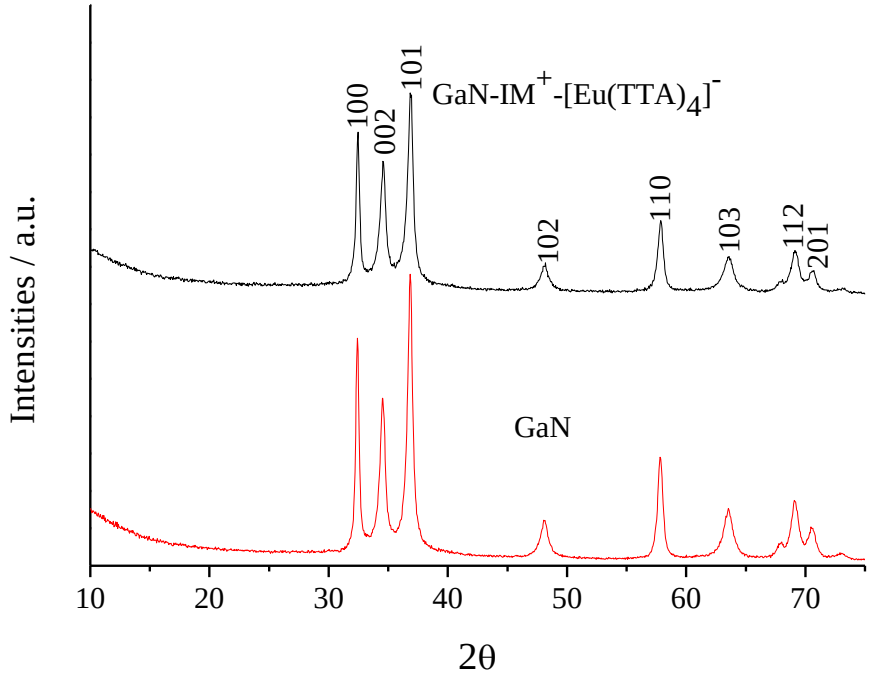

Fig. S1

Fig. S2 SEM image of the GaN-IM^{+}-$[Eu(TTA)_4]^{-}$.

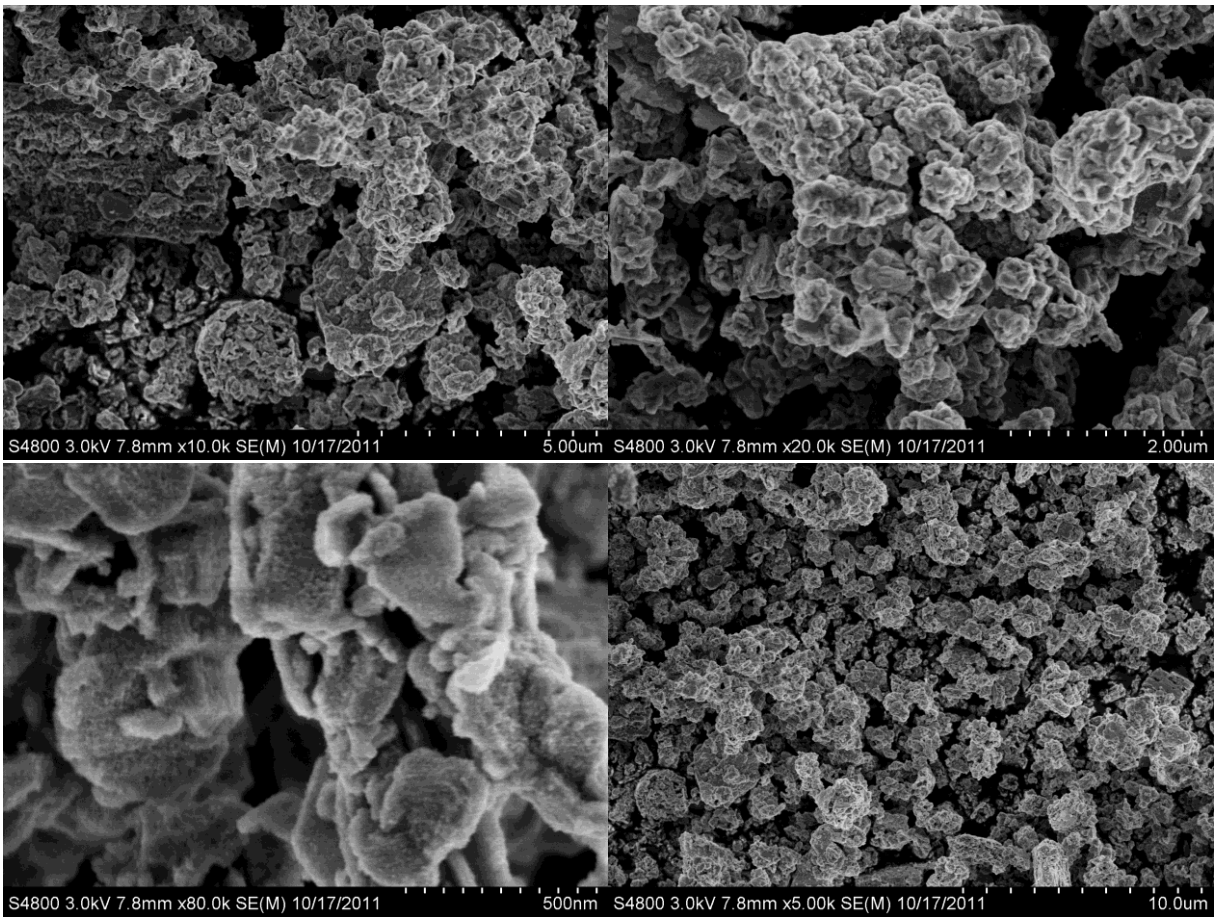

Fig. S2

Fig. S3 Ultraviolet–visible diffuse refrection absorption spectra for GaN-IM^{+}-[Eu(TTA)$_4$]$^{-}$.

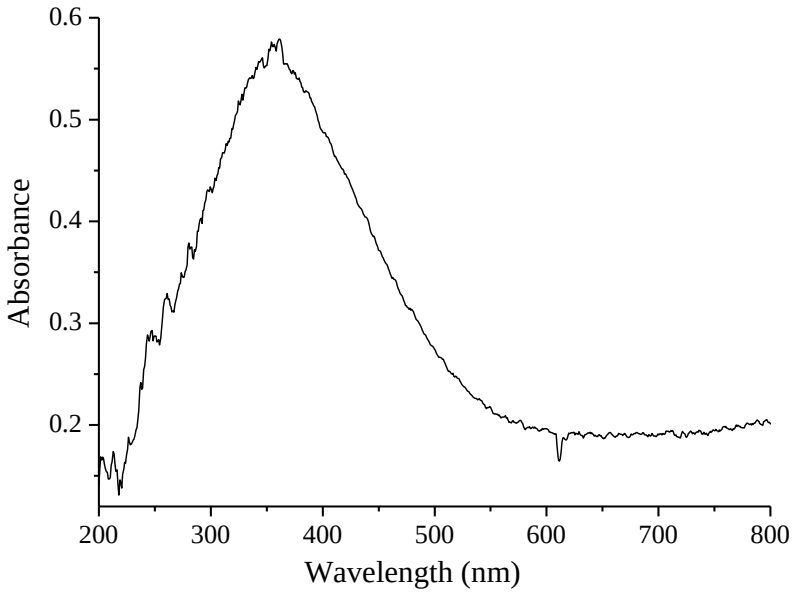

Fig. S3

Table S1 Luminescence efficiency and lifetime for the GaN-IM^{+}-$[Eu(TTA)_4]^{-}$.

Sample	I_{02}/I_{01}	τ (μs)[1]	$1/\tau$ (s^{-1})	A_r (s^{-1})	A_{nr} (s^{-1})	η (%)
GaN-IM^{+}-$[Eu(TTA)_4]^{-}$	16.1	316	3165	831	2334	26.3

The emission quantum efficiency of the $^5D_0$ europium ion excited state for GaN-IM^{+}-$[Eu(TTA)_4]^{-}$ is calculated using the following equations:

$$A_{0J} = A_{01} \times \frac{I_{0J}}{I_{01}} \times \frac{\nu_{01}}{\nu_{0J}}$$

$$A_r = \sum A_{0J} = A_{00} + A_{01} + A_{02} + A_{03} + A_{04}$$

$$\frac{1}{\tau} = A_r + A_{nr}$$

$$\eta = \frac{A_r}{A_r + A_{nr}}$$

Here A_{0J} is the experimental coefficient of spontaneous emissions. A_r and A_{nr} are the radiative and nonradiative transition rates, respectively. I_{0J} is the emission intensity and can be taken as the integrated intensities of the $^5D_0 \rightarrow {}^7F_J$ (J=0—4) emission bands, while the ν_{0J} refers to corresponding energy barycenter and can also be determined from their emission bands. Since the A_{01} is the Einstein's coefficient of spontaneous emission between the $^5D_0$ and $^7F_1$, whose value is given by the equation $A_{01} = 0.31\times10^{-11}n^3(\nu_{01})^3$. When an average index of refraction n = 1.506 is considered, the value of A_{01} can be determined to be 50 s^{-1} approximately.