Electronic Supplementary Information (ESI)

Self-assembled luminescent cholate gels induced by europium ion in deep eutectic solvents

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Gel Formation of NaC in ChU

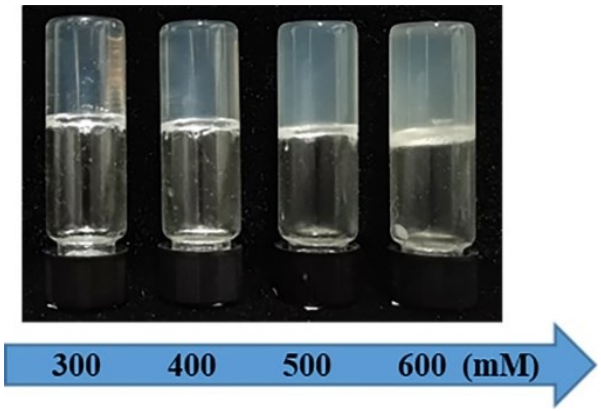


Fig. S1 Photos of NaC gels in ChU at different concentrations.

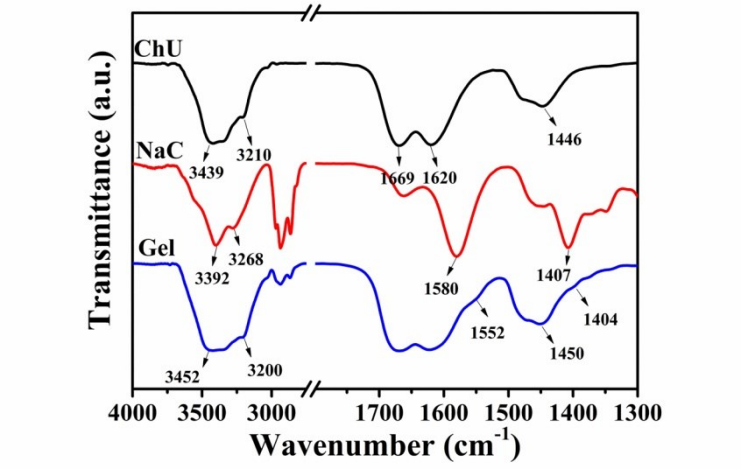
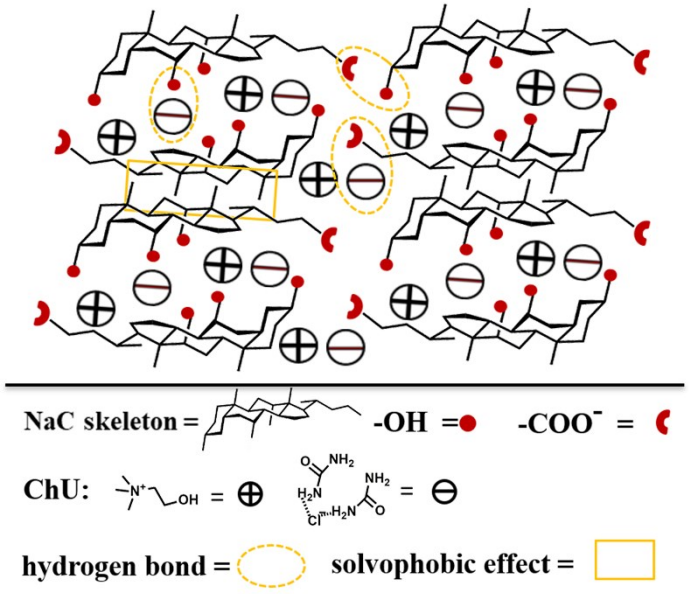


Fig. S2 FTIR spectra of ChU, NaC and NaC gels.



Scheme S1 A schematic representation of possible molecular packing in NaC gel formed in ChU.

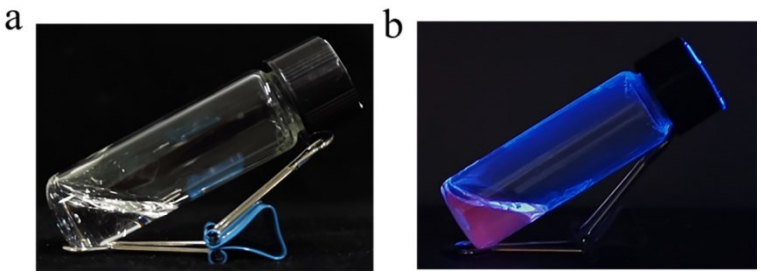


Fig. S3 Photos of a typical NaC (20 mM) /Eu^{3+} (200 mM) mixture solution sample formed in ChU without (a) and with (b) illumination at 365 nm.

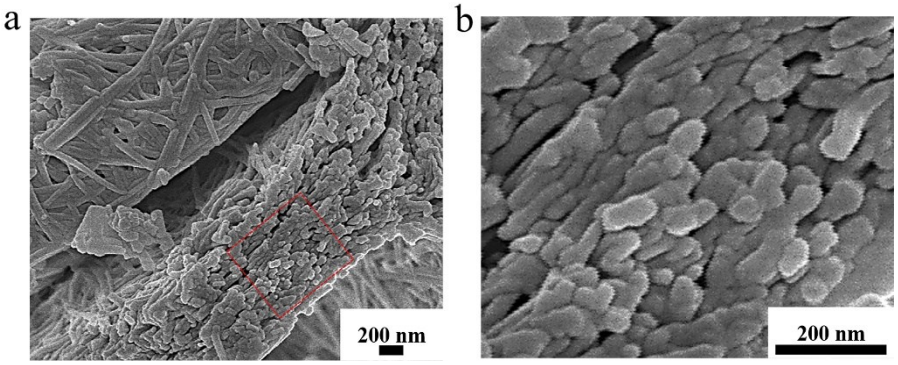


Fig. S4 SEM images of cross-section of NaC/Eu^{3+} xerogel (50 mM/50 mM) formed in ChG (a & b).

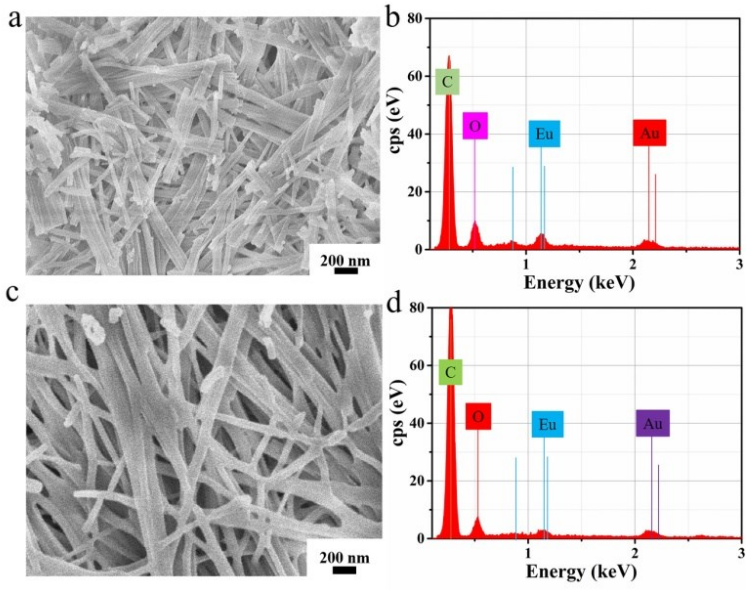


Fig. S5 SEM image and EDS results of NaC/Eu^{3+} xerogels (50 mM/50 mM) formed respectively in ChU (a & b) and ChEG (c & d).

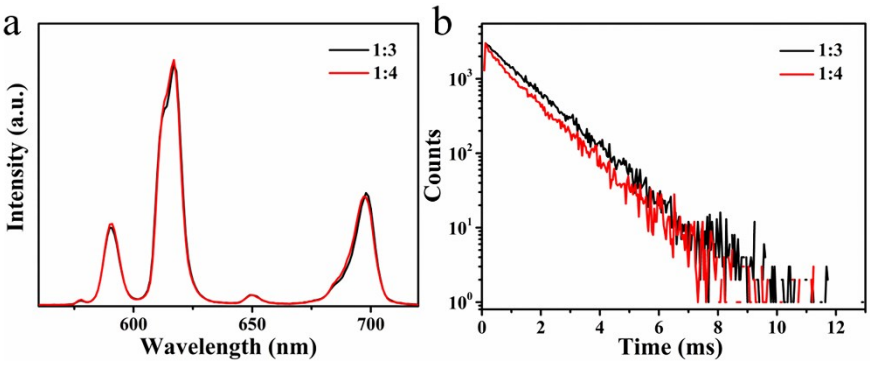


Fig. S6 For NaC/Eu^{3+} (60 mM /20 mM) eutectogels in 1:3 and 1:4 ChCl/glycerol DESs, (a) emission (λ_{ex} = 393 nm) spectra and (b) Time-resolved luminescence decay curves.

Table S1 Characteristic luminescence parameters for eutectogels at C_{NaC}/C_{Eu}^{3+} (60 mM/20 mM) in 1:3 and 1:4 ChCl/glycerol DESs.

System	τ (ms)	*Q* (%)
1:3 ChCl/glycerol DES	1.21	46.50
1:4 ChCl/glycerol DES	1.09	41.98

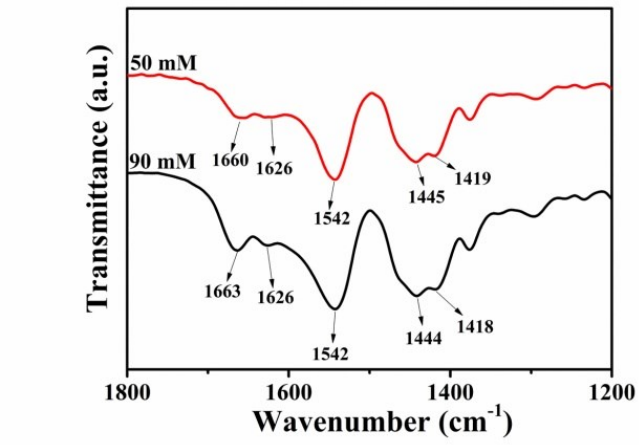


Fig. S7 FTIR spectra of xerogels formed in ChU at C_{Eu}^{3+} = 30 mM and two different C_{NaC}.

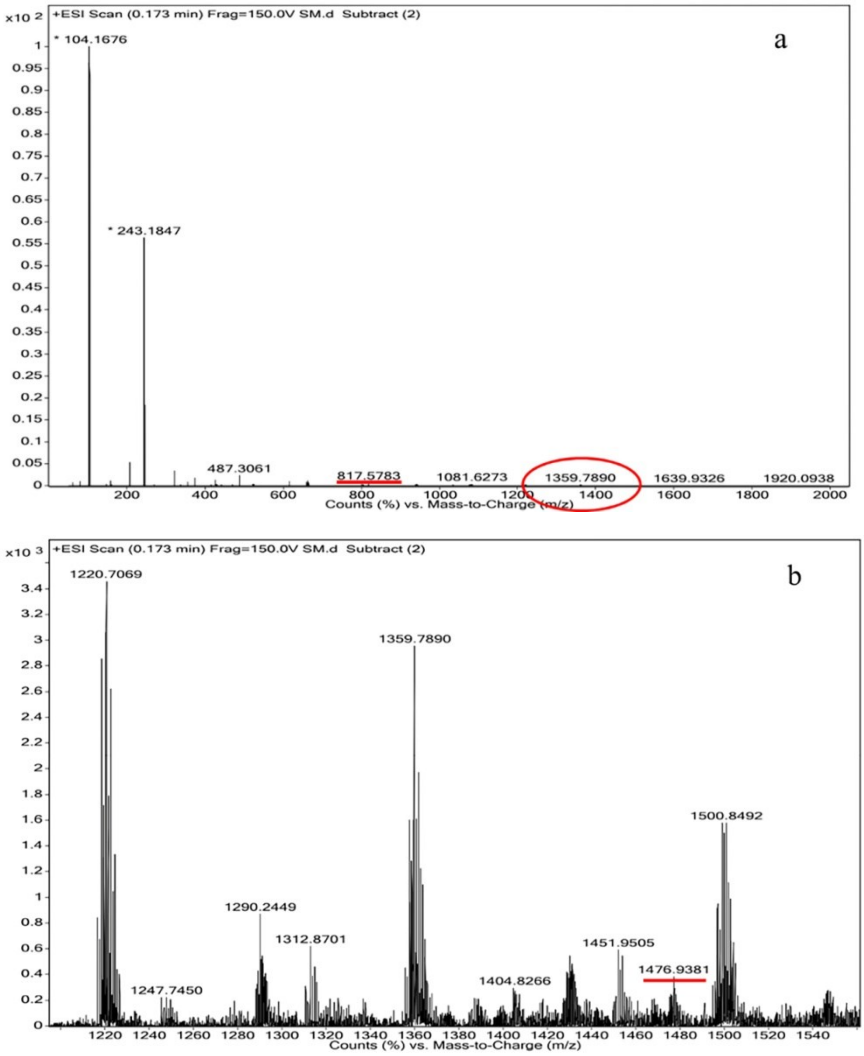


Fig. S8 (a) ESI-MS spectrum of Eu^{3+}/NaC supramolecular gel in ChG with (b) magnified part near 1359.7890 (m/z).

The coordination of NaC to Eu^{3+} in gel formed in ChG was characterized by electrospray ionization mass spectrometry (ESI-MS). The peaks at m/z of 817.5783 (Fig. S8a) and 1476.9381 (Fig. S8b) could be identified into the formula $[(C_{24}H_{39}O_5)_2H_3]^+$ and $[Eu(C_{24}H_{39}O_5)_3Ch]^+$ (Ch = choline cation). This result revealed that one Eu^{3+} ion was coordinated with three carboxyl groups. Although the quantification of the individual species by ESI-MS is not feasible, this technique is known to give a snapshot of species present in solution.[1]

Calculation of the radiative (k_r) or nonradiative (k_{nr}) rate constants and quantum efficiency (Q)

Because of its stable intensity, the $^5D_0 \rightarrow {}^7F_1$ transition can be taken as a reference for the calculation of quantum efficiency (Q). On the basis of intensity parameters obtained from the emission spectra, the total radiative rate of $^5D_0$ can be given by eq. (1),

$$k_r = \sum_{J=0}^{4} k_{0\rightarrow J} = k_{01} \sum_{J=0}^{4} \left(\frac{S_{0J}}{S_{01}} \right) \left(\frac{v_{01}}{v_{0J}} \right) \tag{1}$$

where S_{0J} and v_{0J} were the integrated intensities and energy barycentres of $^5D_0 \rightarrow {}^7F_J$ ($J = 0 \sim 4$) transitions in the emission curves, respectively.[2,3] k_{01} was the Einstein coefficient of spontaneous emission for $^5D_0 \rightarrow {}^7F_1$ transition and could be determined as ~ 50 s^{-1} in air for solid samples.[4]

Based on the fitted lifetimes (τ), the total decay rate of $^5D_0$ (k_{tot}) could be calculated by eq. (2).[2,3]

$$k_{tot} = \frac{1}{\tau} = k_r + k_{nr} \tag{2}$$

Assuming that only nonradiative and radiative decay processes were involved in the depopulation of $^5D_0$ state, the emission quantum efficiency (Q) could be determined using the eq. (3).

$$Q = \frac{k_r}{k_r + k_{nr}} \tag{3}$$

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