Supporting Information

for

Synthesis of rare-earth metal and rare-earth metal-fluoride nanoparticles in ionic liquids and propylene carbonate

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Additional experimental data

Content

Thermogravimetric analysis, TGA of rare earth amidinates and $Eu(dpm)_3$

Table S1: Thermogravimetric analysis of the rare earth metal amidinates and $Eu(dpm)_3$[a].

Precursor	Decomposition temperature [°C]	Δm_{TGA} (exptl/calcd)
$Pr(amd)_3$	160	66/70
$Eu(dpm)_3$	220	89/79
$Gd(amd)_3$	230	90/74
$Er(amd)_3$	220	82/72

[a] See thermogravimetric diagrams in Figure S2.

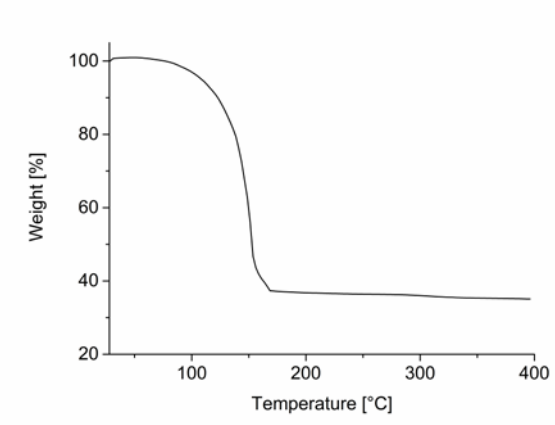


Figure S2a: TGA $Pr(amd)_3$, 25–400 °C, 5 K/min.

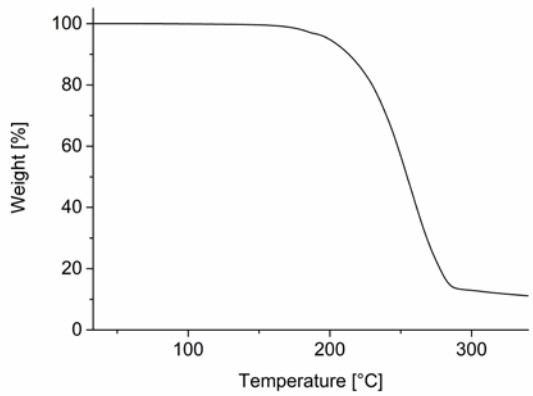


Figure S2b: TGA $Eu(dpm)_3$, 25–350 °C, 5 K/min.

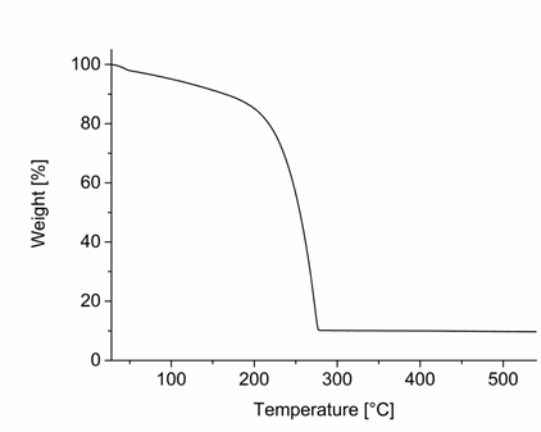


Figure S2c: TGA $Gd(amd)_3$, 25–550 °C, 5 K/min.

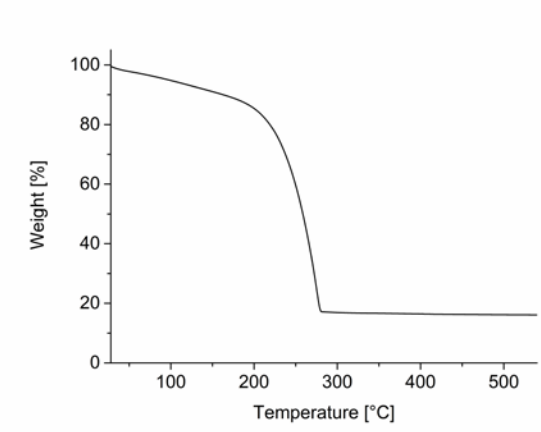
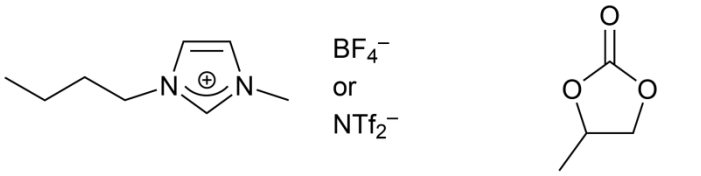


Figure S2d: TGA $Er(amd)_3$, 25–550 °C, 5 K/min.

Structural formulas of the ionic liquids (ILs) and propylene carbonate (PC)



1-*n*-butyl-3-methyl-imidazolium
- tetrafluoroborate [BMIm][BF_4]
- bistriflimide [BMIm][NTf_2], NTf_2^- = $[(CF_3SO_2)_2N]^-$

propylene
carbonate, PC

Figure S3: Ionic liquids (ILs) and propylene carbonate (PC) used as reaction media and stabilizer for NP syntheses.

TEM images, particle size histogram, PXRD, SAED, EDX and XPS of REF_3-NPs

PrF_3-NPs in [BMIm][BF_4]

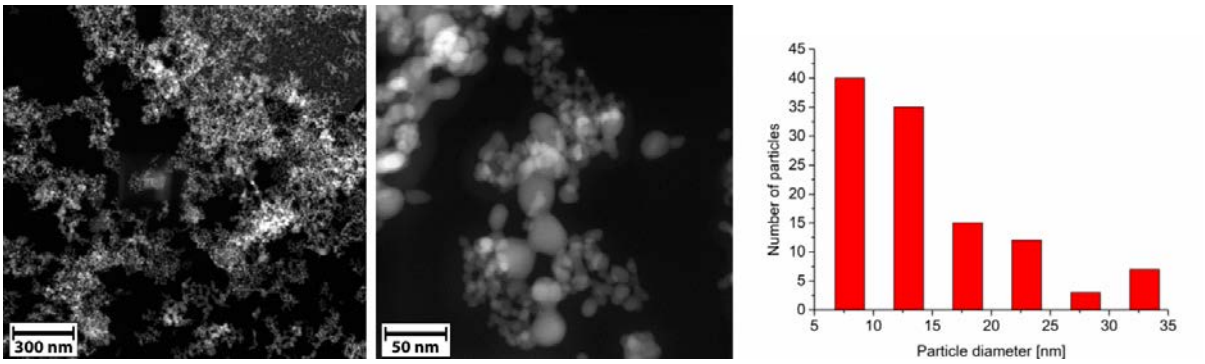


Figure S4a: HAADF-STEM images and particle size histogram of 1.0 wt % PrF_3-NPs in [BMIm][BF_4] from $Pr(amd)_3$.

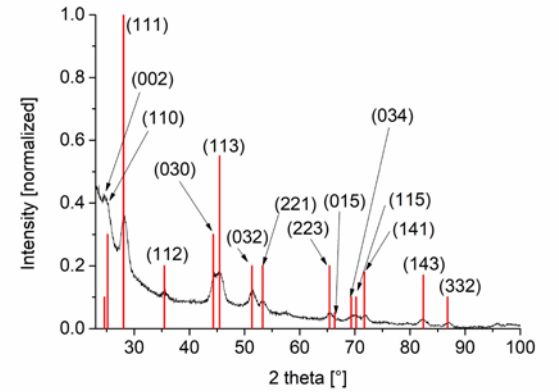


Figure S4b: PXRD (PrF_3 reference peaks in red from COD 1010984, hexagonal with space group $P6_3/mcm$) of 1.0 wt % PrF_3-NPs in [BMIm][BF_4] from $Pr(amd)_3$.

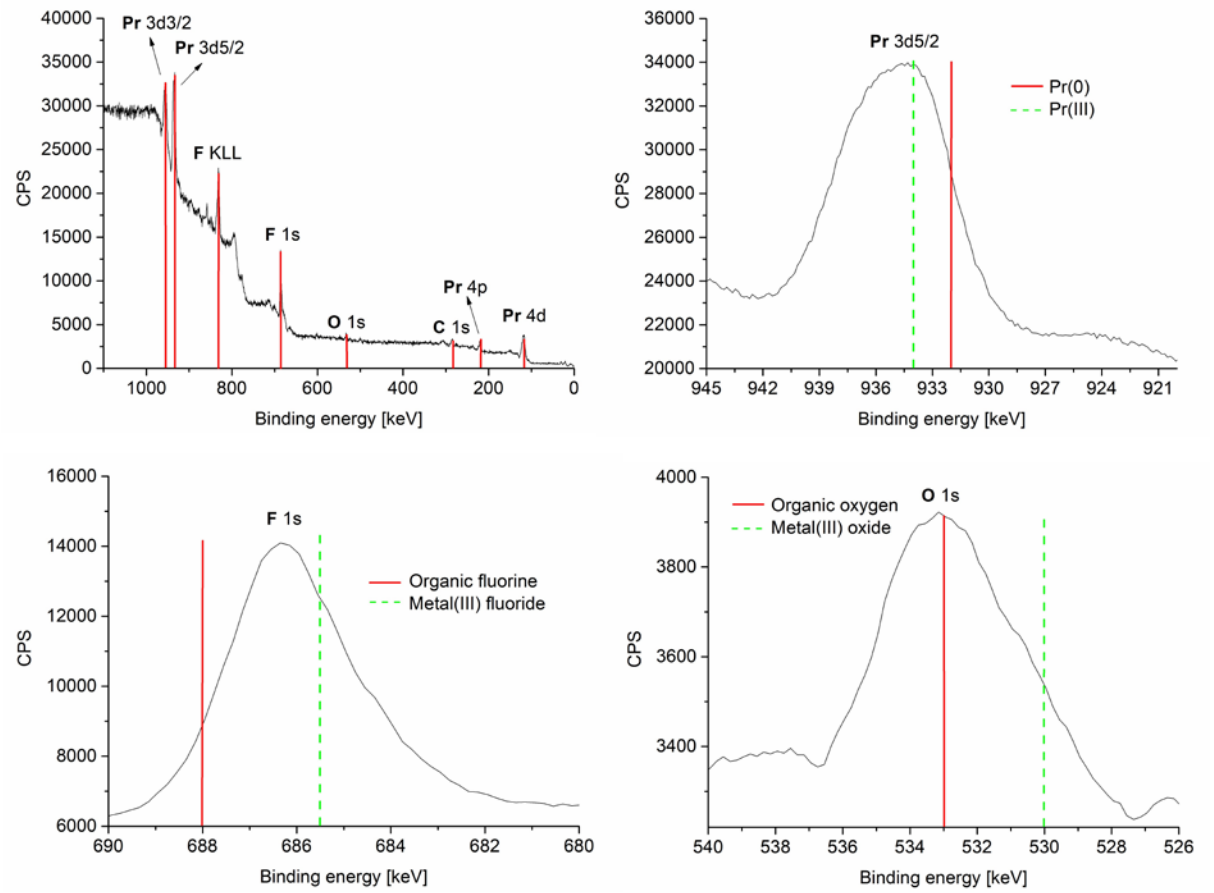


Figure S4c: Overview and HR-XPS of 1.0 wt % PrF_3-NPs in [BMIm][BF_4] from $Pr(amd)_3$. The red and green bars are a guide to the eye on the binding-energy axis.

EuF_3-NPs in [BMIm][BF_4]

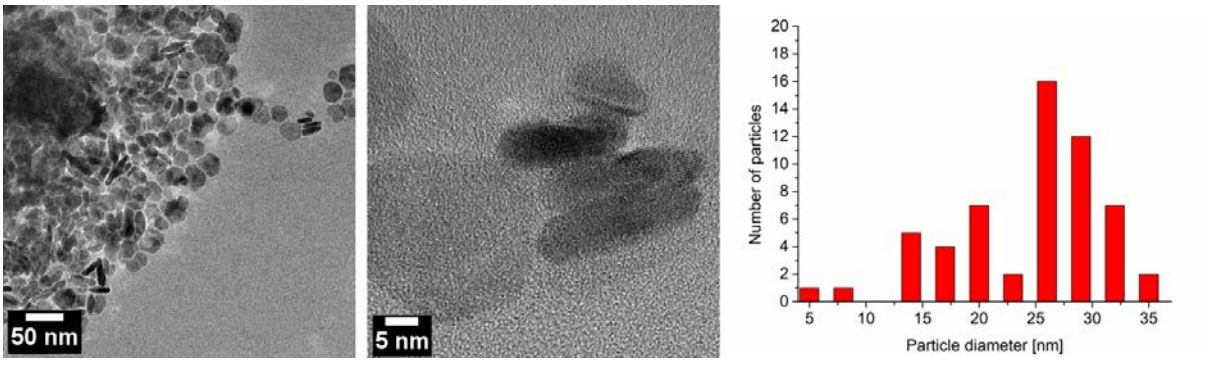


Figure S5a: TEM images and particle size histogram of 1.0 wt % EuF_3-NPs in [BMIm][BF_4] from $Eu(dpm)_3$.

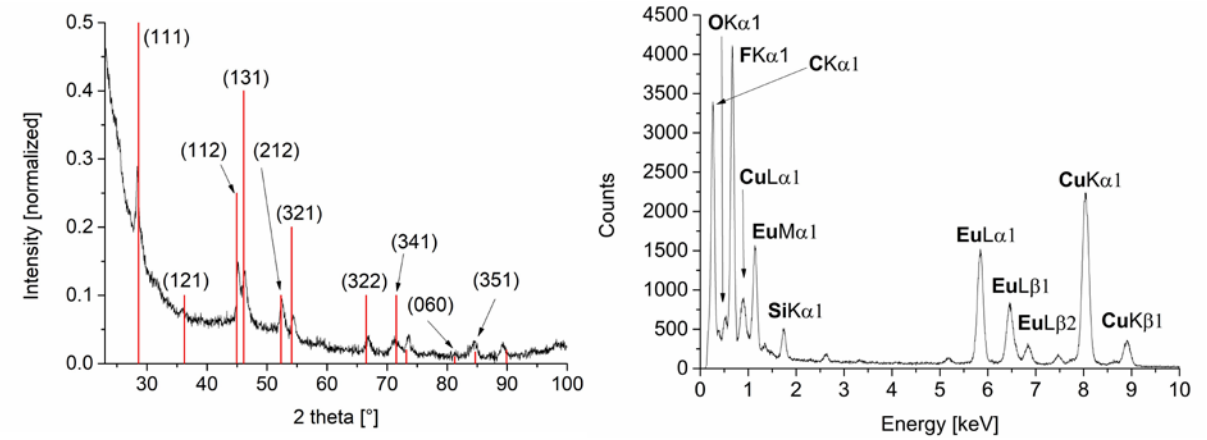


Figure S5b: PXRD (EuF_3 reference peaks in red from COD 1532444, orthorhombic with space group Pnma) and EDX of 1.0 wt % EuF_3-NPs in [BMIm][BF_4] from $Eu(dpm)_3$.

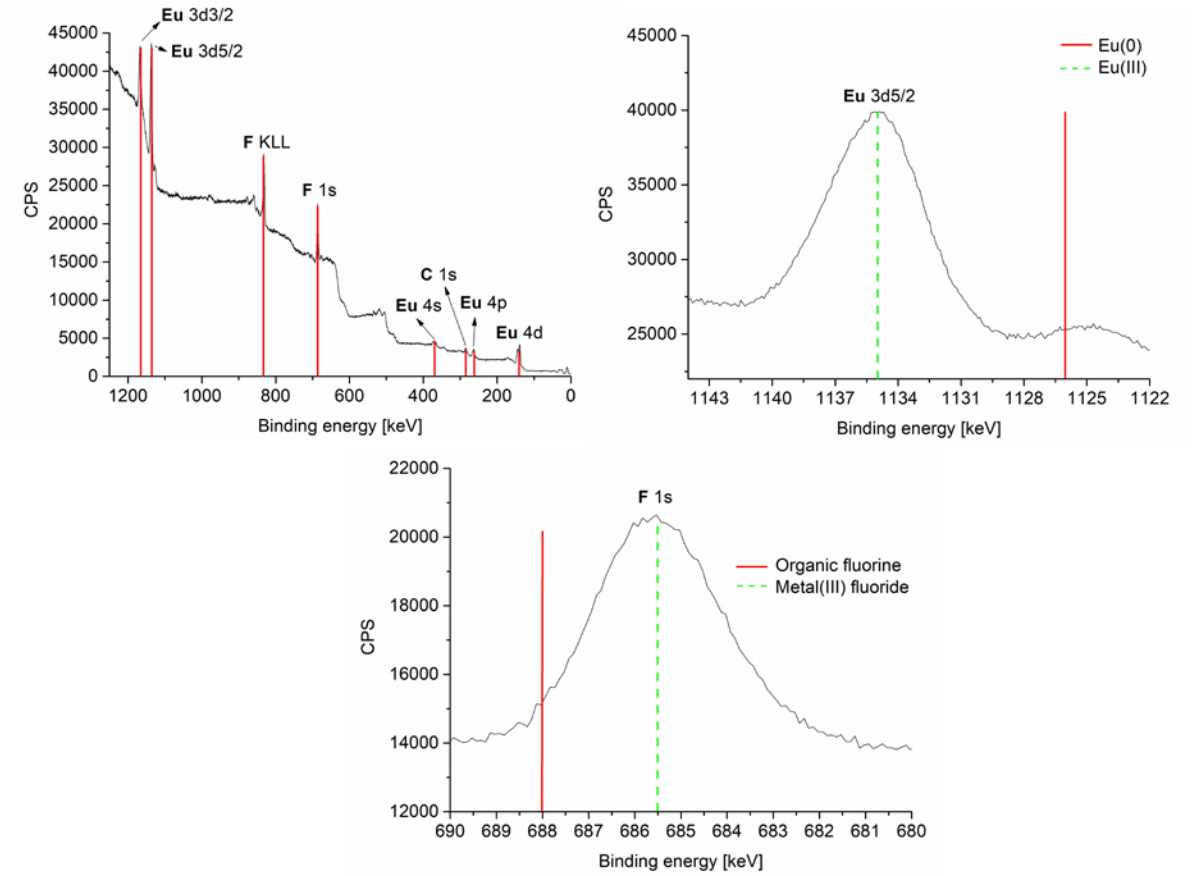


Figure S5c: Overview and HR-XPS of 1.0 wt % EuF_3-NPs in [BMIm][BF_4] from $Eu(dpm)_3$. The red and green bars are a guide to the eye on the binding-energy axis.

GdF_3-NPs in [BMIm][BF_4]

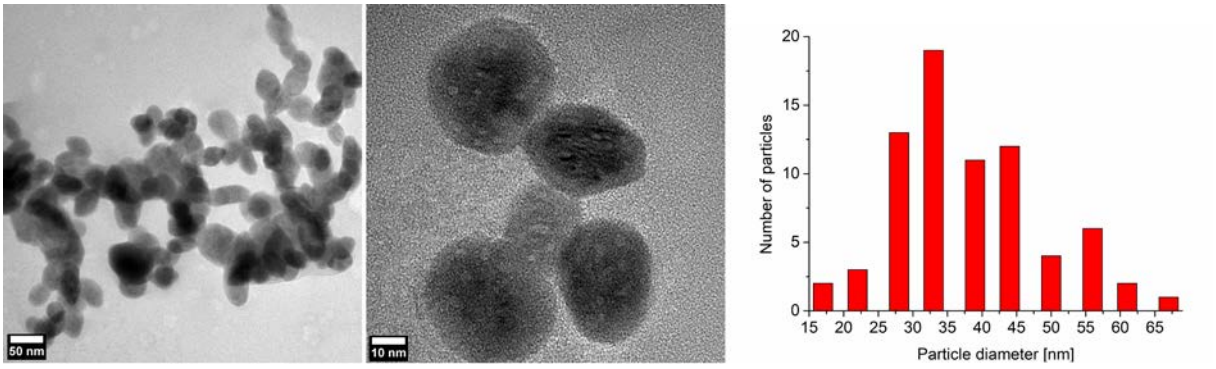


Figure S6a: TEM images and particle size histogram of 1.0 wt % GdF_3-NPs in [BMIm][BF_4] from $Gd(amd)_3$.

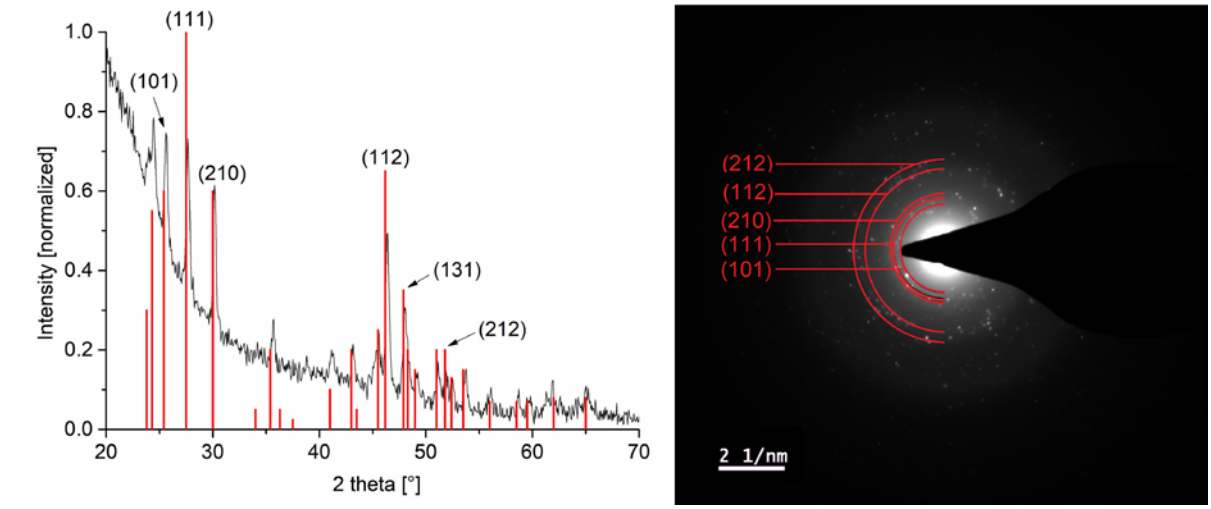


Figure S6b: PXRD and SAED (GdF_3 reference peaks in red from ICDD 0120788, orthorhombic with space group *Pnma*) of 1.0 wt % GdF_3-NPs in [BMIm][BF_4] from $Gd(amd)_3$.

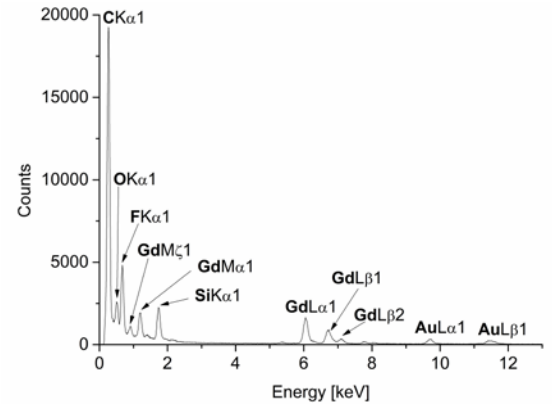


Figure S6c: EDX of 1.0 wt % GdF_3-NPs in [BMIm][BF_4] from $Gd(amd)_3$.

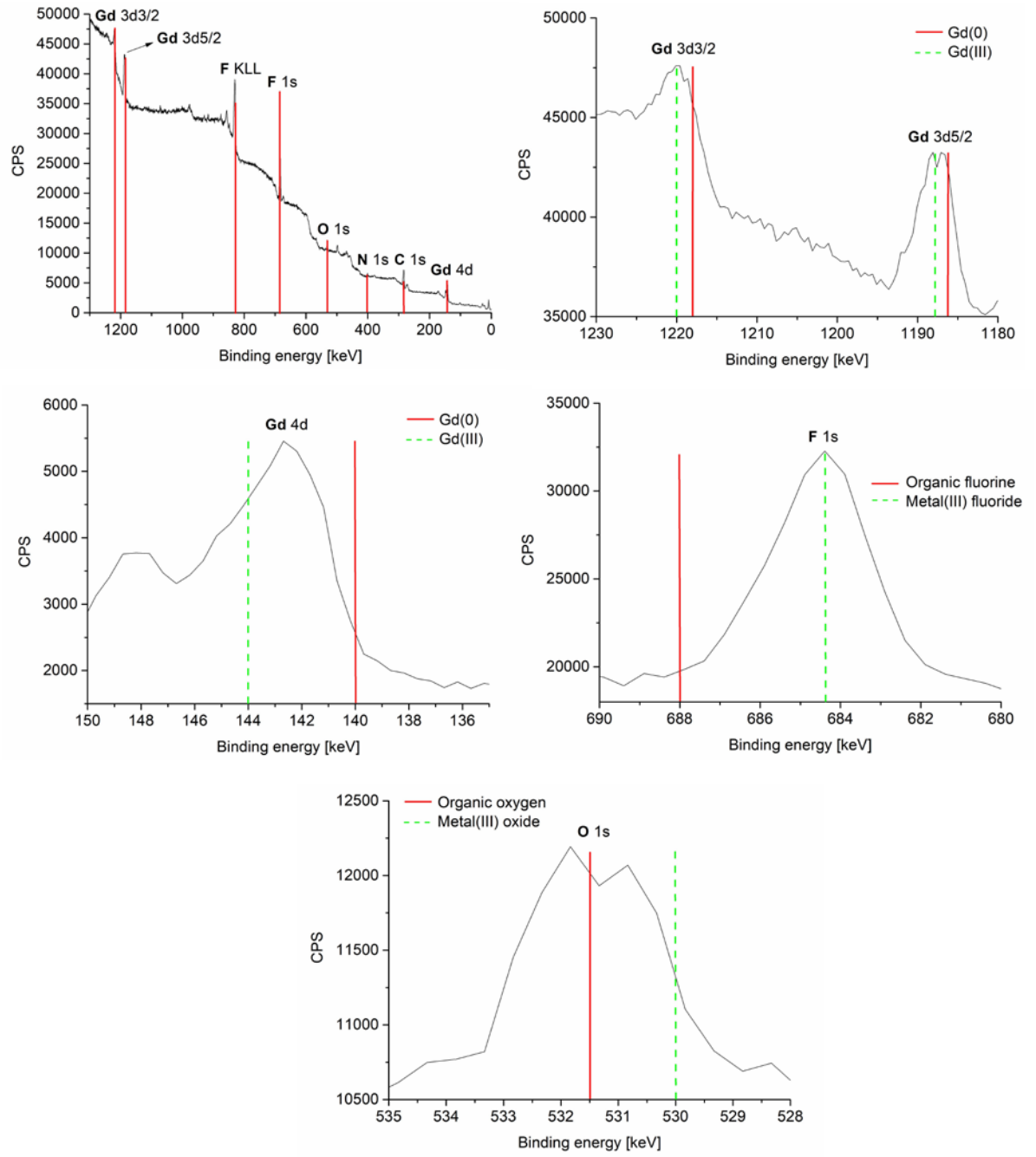


Figure S6d: Overview and HR-XPS of 1.0 wt % GdF_3-NPs in [BMIm][BF_4] from $Gd(amd)_3$. The red and green bars are a guide to the eye on the binding-energy axis.

TEM images, particle size histogram, SAED, EDX and XPS of Er-NPs in [BMIm][NTf_2]

Er-NPs in [BMIm][NTf_2]

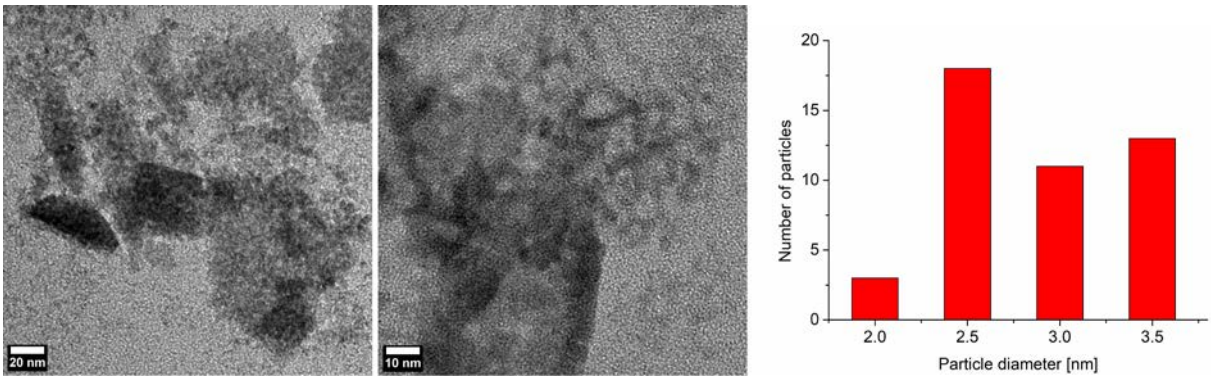


Figure S7a: TEM images and particle size histogram of 1.0 wt % Er-NPs in [BMIm][NTf_2] from $Er(amd)_3$.

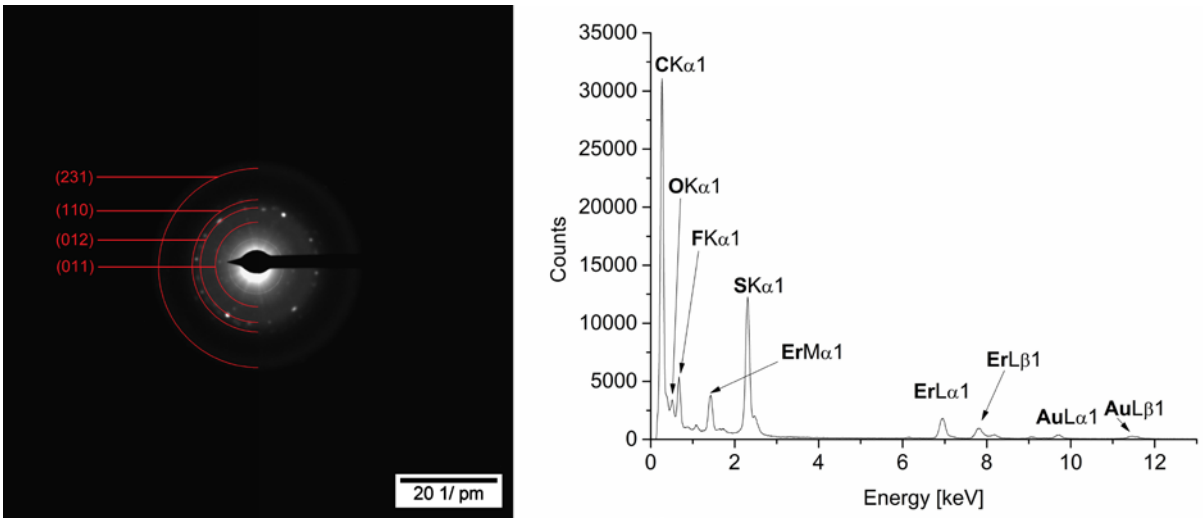


Figure S7b: SAED (Er reference peaks in red from COD 9008496, hexagonal with space group*P*6_3/*mcm*) and EDX of 1.0 wt % Er-NPs in [BMIm][NTf_2] from $Er(amd)_3$.

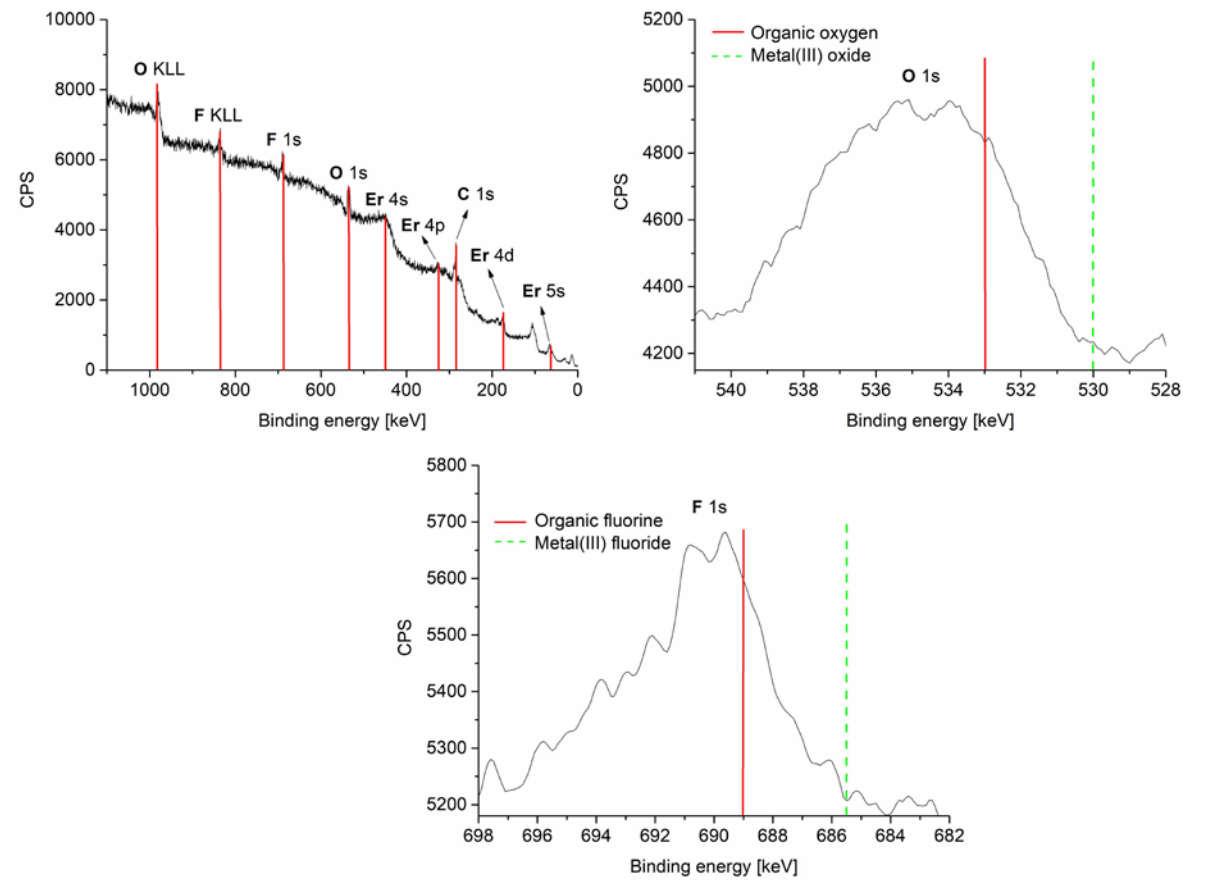


Figure S7c: Overview and HR-XPS of 1.0 wt % Er-NPs in [BMIm][NTf_2] from $Er(amd)_3$. The red and green bars are a guide to the eye on the binding-energy axis.

TEM images, particle size histogram, SAED, EDX and XPS of RE-NPs in PC

Pr-NPs in PC

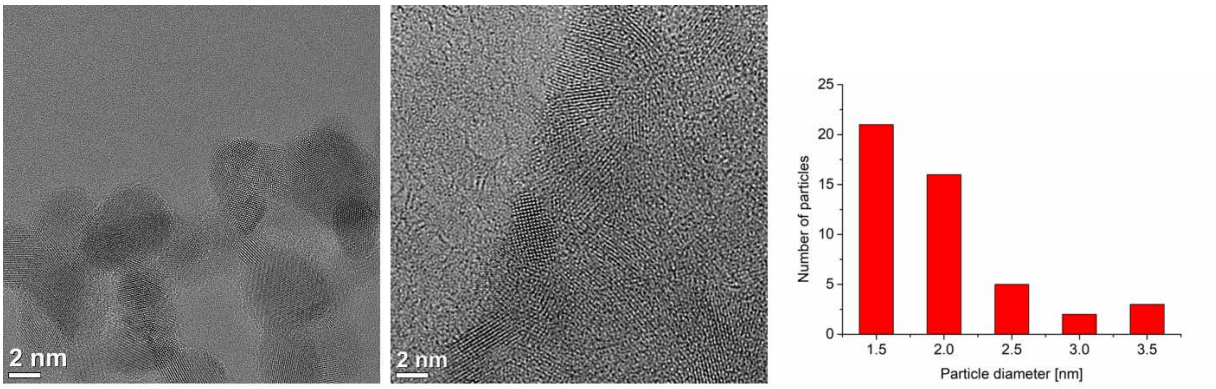


Figure S8a: TEM images and particle size histogram of 1.0 wt % Pr-NPs in PC from $Pr(amd)_3$.

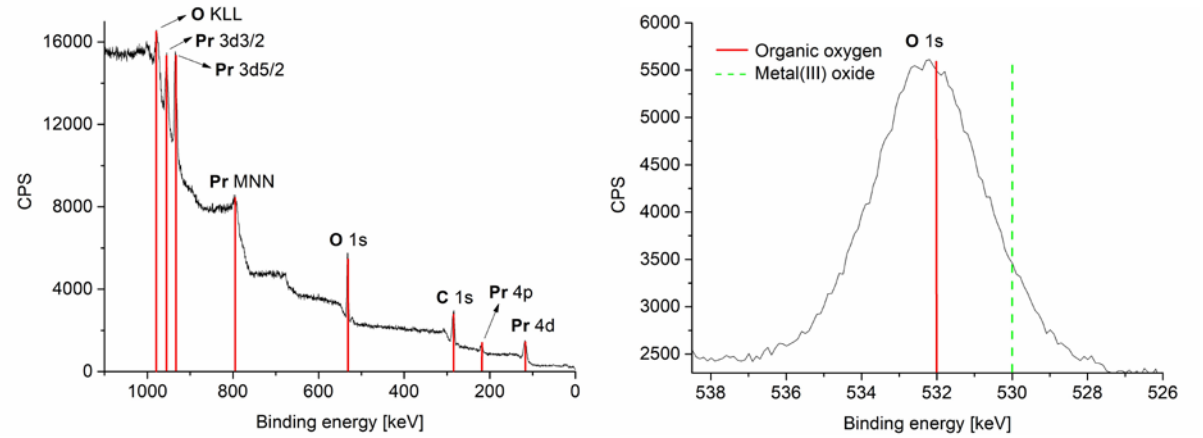


Figure S8b: Overview and HR-XPS of 1.0 wt % Pr-NPs in PC from $Pr(amd)_3$. The red and green bars are a guide to the eye on the binding-energy axis.

Er-NPs in PC

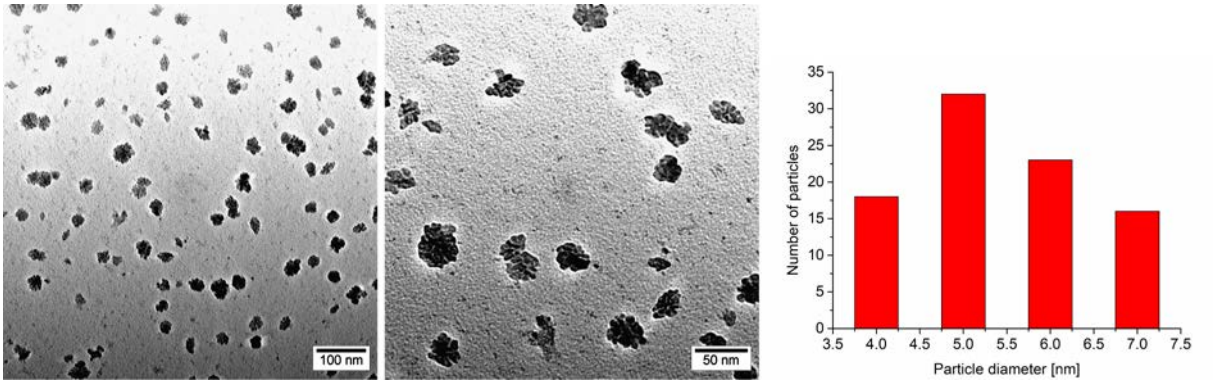


Figure S9a: TEM images and particle size histogram of 1.0 wt % Er-NPs in PC from $Er(amd)_3$.

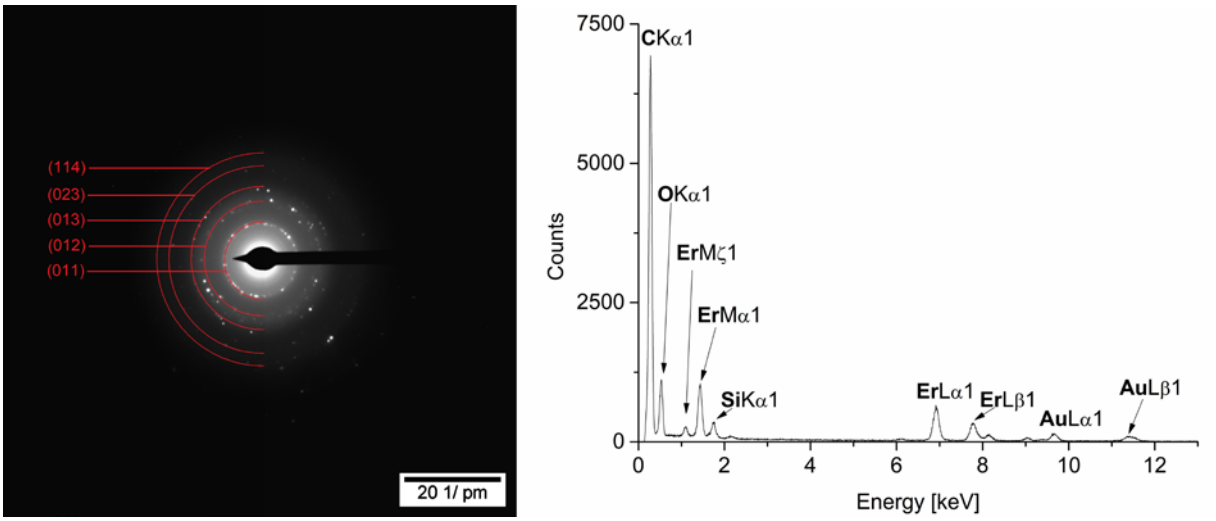


Figure S9b: SAED (Er reference peaks in red from COD 9008496, hexagonal with space group $P6_3/mcm$) and EDX of 1.0 wt % Er-NPs in PC from $Er(amd)_3$.

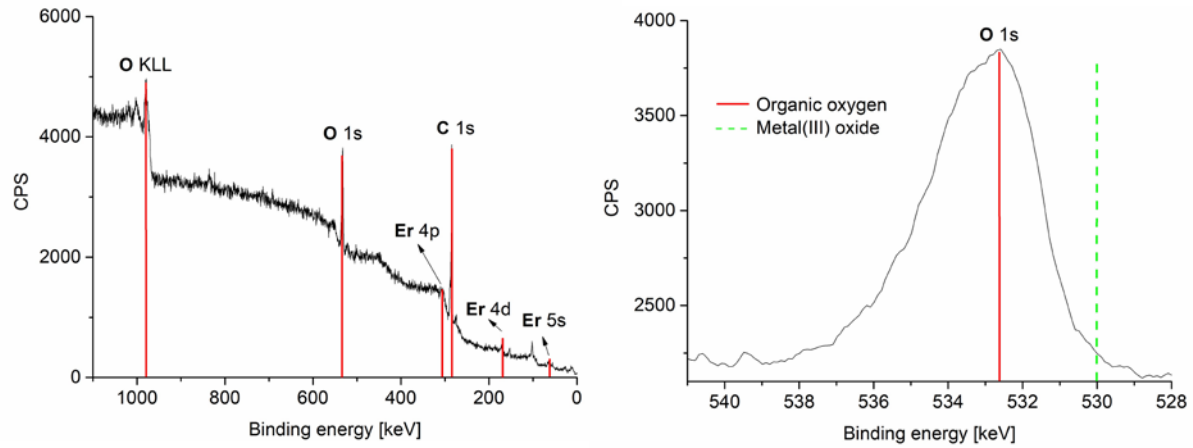


Figure S9c: Overview and HR-XPS of 1.0 wt % Er-NPs in PC from $Er(amd)_3$. The red and green bars are a guide to the eye on the binding-energy axis.