Electronic Supplementary Information

A novel lanthanide based NIR-II nanoprobe for lung squamous-cell carcinoma identification

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Table S1 Quantum yield of related Er nanoprobes.

Serial number	Structure composition	Quantum yield	Solvent	Reference
1	$NaErF_4$@$NaYF_4$@SCCA	0.051%	Water	This work
2	$NaErF_4$@$NaLnF_4$	10.2%	Hexane	1
3	$NaErF_4$@$NaYbF_4$@$NaYF_4$	18.7%	-	2
4	$NaCeF_4$:Er/Yb	32.8%	Cyclohexane	3
5	$NaGdF_4$@$NaGdF_4$:Yb/Er(18/45%) @$NaNdF_4$:(10%)	0.009%	Cyclohexane:	4

Supplementary Note 1:

The quantum yield of the DCNPs@anti-SCCA probe was measured by using a standard dye IR-26 as the reference. Both were excited by a 980 nm laser under identical intensity (2 W/cm^2). The quantum yield of the DCNPs@anti-SCCA probe was estimated as

$$Q_{probe} = Q_{ref} \times \frac{S_{probe}}{S_{ref}} \times \left(\frac{n_{probe}}{n_{ref}}\right)^2$$

where Q_{probe} is the quantum yield of the DCNPs@anti-SCCA probe, Q_{ref} is the quantum yield of IR-26 (~ 0.05%), S_{probe} and S_{ref} are the slopes obtained by linear fitting of the integrated emission spectra of DCNPs@anti-SCCA probe (1400 nm-1600 nm) and IR-26 (1000 nm -1500 nm) against the absorbance at 980 nm, n_{probe} and n_{ref} are the refractive indices of their respective solvents (water: 1; and dichloroethane: 1.4167).

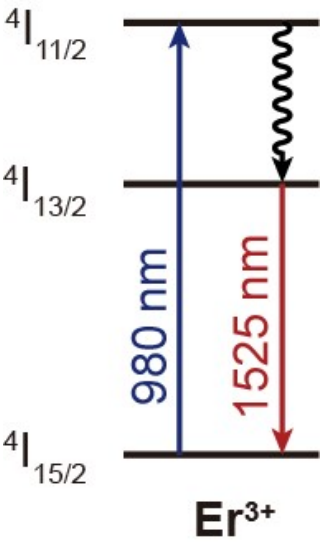

Figure S1 Schematic energy level diagram showing the possible downconversion mechanism of $NaErF_4$@$NaYF_4$ nanoparticles.

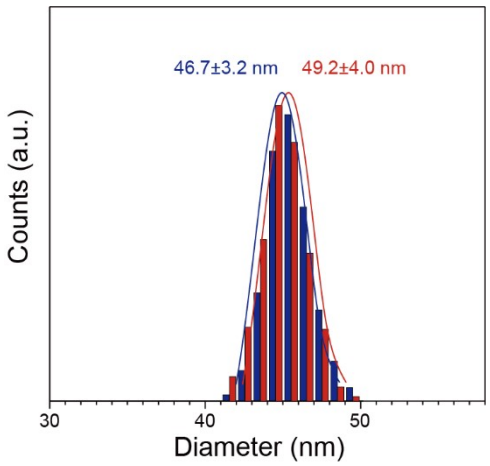

Figure S2 Corresponding size distributions of $NaErF_4$ (blue) and $NaErF_4$@$NaYF_4$ (red) nanoparticles.

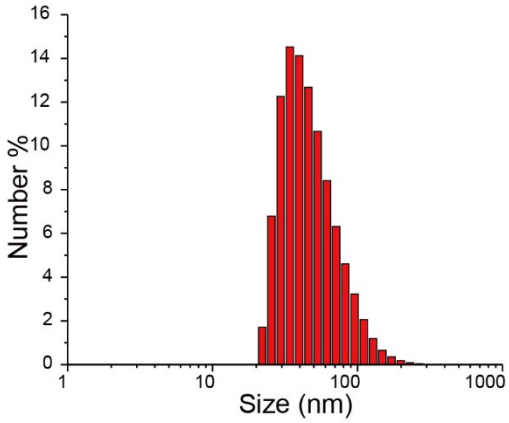

Figure S3 Dynamic light scattering (DLS) measurement of DCNPs@anti-SCCA nanoprobes in PBS.

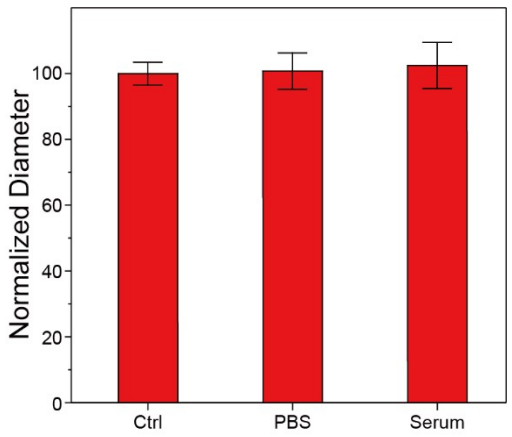

Figure S4 Dynamic light scattering (DLS) measurement of DCNPs@anti-SCCA after storing in PBS buffer and mouse serum at 37 °C for 3 days.

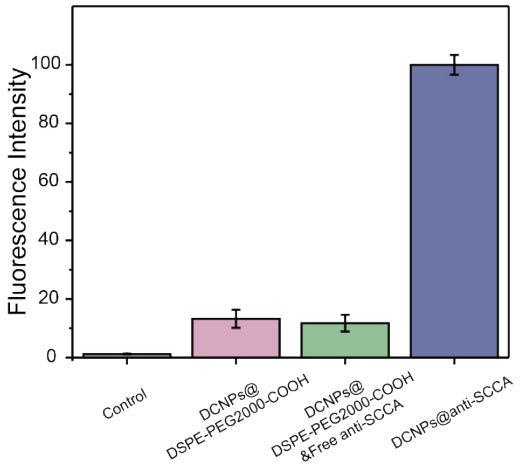

Figure S5 NIR-II fluorescence intensity of NCI-H1703 cells incubated with DCNPs@DSPE-PEG2000-COOH, DCNPs@DSPE-PEG2000-COOH & free anti-SCCA, and DCNPs@anti-SCCA.

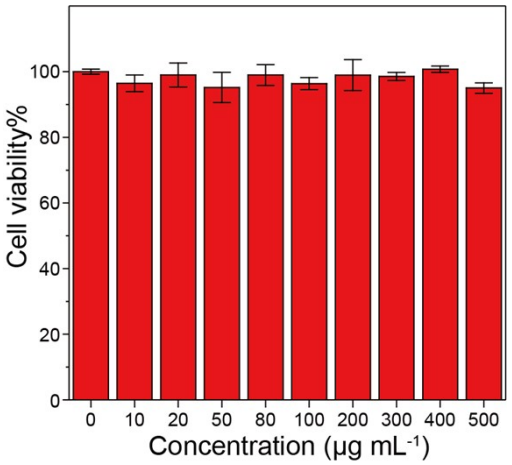

Figure S6 Cell viability of NCI-H1703 cells incubated with DCNPs@anti-SCCA for 24 h at 37 ℃.

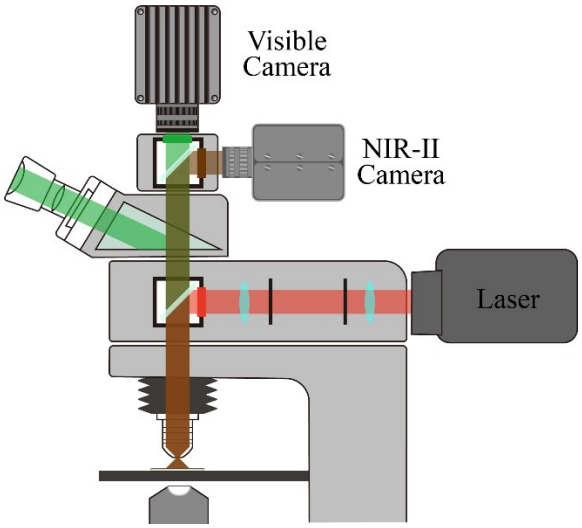

Figure S7 Scheme of fluorescence microscope with Si visible detector and InGaAs NIR-II detector.

Figure S8 NIR-II fluorescence image of mouse model with lung squamous cell (NCI-H1703) carcinoma.

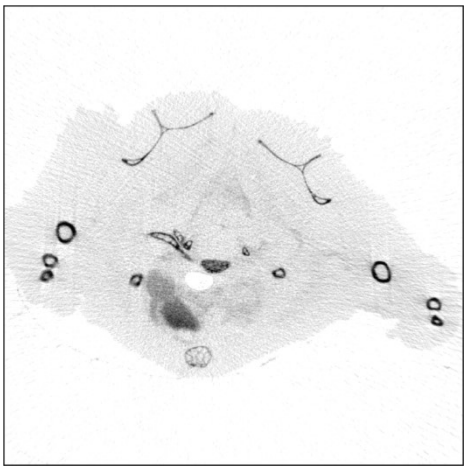

Figure S9 CT image of a BALB/c nude mouse with squamous non-small-cell lung cancer.

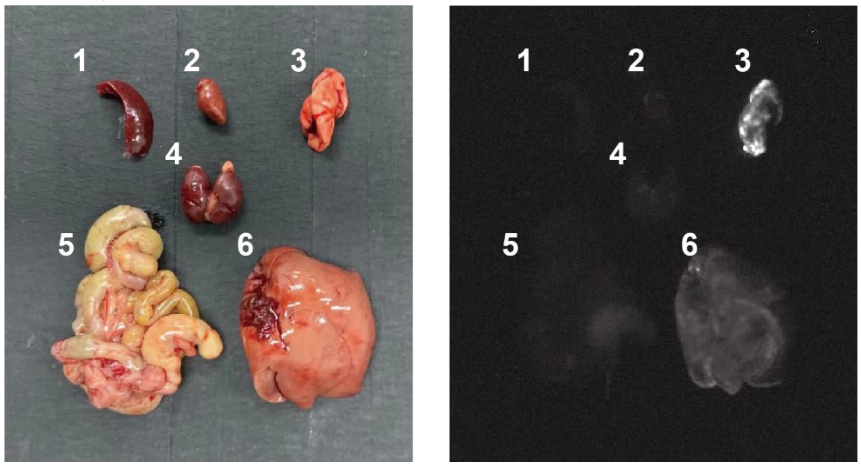

Figure S10 Bright field and NIR-II fluorescence images of different organs obtained by sacrificing mouse after in vivo imaging. Nos.1-6 refers to spleen, heart, lung, kidneys, intestine and liver.

1 H. Li, X. Wang, X. Li, S. Zeng and G. Chen, *Chemistry of Materials*, 2020, **32**, 3365-3375.

2 Y. Li, P. Zhang, H. Ning, J. Zeng, Y. Hou, L. Jing, C. Liu and M. Gao, *Small*, 2019, **15**, 1905344.

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4 Y. Fan, P. Wang, Y. Lu, R. Wang, L. Zhou, X. Zheng, X. Li, J. A. Piper and F. Zhang, *Nature nanotechnology*, 2018, **13**, 941-946.