Supplementary Experimental Section.

Synthesis of the Polymerisable pH-Indicator.
The synthesis of the pH-indicator dye N2 was done in a comparable procedure to the reported method of Niu et al.1 (Scheme 1).

**Scheme 1** Synthesis of the polymerisable pH-indicator dye N2.

Synthesis of N-Allyl-4-bromo-1,8-naphthalimide (N1).
1 g (3.4 mmol) of 4-bromo-1,8-naphthalic anhydride was suspended in 25 mL of absolute ethanol and heated up to 70 °C. Upon addition of 330 µl (4.4 mmol) of allyl amine the reaction mixture turned brown. Afterwards the mixture was heated under reflux until the starting compound was completely dissolved. After 30 minutes of stirring the product precipitated and the reaction was refluxed for further 2 hours. The reaction was cooled to room temperature and the solid product was filtered, washed with ethanol and dried *in vacuo*. The product was purified by recrystallization from ethanol. Yield: pale brown needles (0.98 g, 92%).

\[ \text{mp 152 °C (from EtOH).} \]

Elemental analysis: Found: C, 57.1; H, 3.1; N, 4.4. Calc. for C_{15}H_{10}N_{1}O_{2}Br (316.2): C, 57.2; H, 3.2; N, 4.5%.

NMR data: \( \delta_{H}(400 \text{ MHz}; \text{CDCl}_3) 8.65 (1 \text{ H}, \text{ dd, Ph}), 8.56 (1 \text{ H}, \text{ dd, Ph}), 8.41 (1 \text{ H}, \text{ d, Ph}), 8.03 (1 \text{ H}, \text{ d, Ph}), 7.84 (1 \text{ H}, \text{ dd, Ph}), 6.01 (1 \text{ H}, \text{ m, }-\text{CH=}), 5.34 (1 \text{ H}, \text{ dd, }-\text{CH}_2), 5.23 (1 \text{ H}, \text{ dd, }-\text{CH}_2), 4.80 (2 \text{ H}, \text{ m, }-\text{CH}_2-) \text{ ppm).} \)

\( \delta_{C}(100 \text{ MHz; CDCl}_3) 163.3 (2 \text{ C}), 133.3, 132.1, 132.0, 131.3, 131.1, 130.6, 130.3, 129.0, 128.1, 123.3, 122.3, 117.9, 42.5 \text{ ppm).} \)

MS (EI): m/z 315 (M+•, 20%), 300 (M-15, base peak).

Synthesis of N-Allyl-4-(N-methylpiperazinyl)-1,8-naphthalimide (N2).
0.47 g (1.5 mmol) of N-allyl-4-bromo-1,8-naphthalimide, 0.9 g (9 mmol) of N-methyl-piperazine and 1 mg (9·10^{-3} mmol) of hydroquinone were suspended in 10 mL of 2-methoxyethanol and refluxed for 4 hours at 140 °C until the reagents were dissolved. The conversion was controlled using TLC with dichloromethane/methanol 5:1 (v/v) as the eluent. The product was precipitated by pouring the dark yellow solution into 50 mL of an ice-water mixture. The yellow precipitate was filtered, washed with 20 mL of ethanol and dried *in vacuo*. The product was further purified by recrystallization from ethanol. Yield: yellow needles (0.24 g, 48%).

\[ \text{mp 152 °C (from EtOH).} \]

Elemental analysis: Found: C, 71.6; H, 6.1; N, 12.4. Calc. for C_{20}H_{21}N_{3}O_{2} (335.4): C, 71.6; H, 6.3; N, 12.5%.

NMR data: \( \delta_{H}(250 \text{ MHz; CDCl}_3) 8.55 (1 \text{ H}, \text{ d, Ph}), 8.49 (1 \text{ H}, \text{ d, Ph}), 8.39 (1 \text{ H}, \text{ d, Ph}), 7.66 (1 \text{ H}, \text{ t, Ph}), 7.19 (1 \text{ H}, \text{ d, Ph}), 5.98 (1 \text{ H}, \text{ m, }-\text{CH=}), 5.28 (1 \text{ H}, \text{ dd, }-\text{CH}_2), 5.17 (1 \text{ H}, \text{ dd, }-\text{CH}_2), 4.77 (2 \text{ H}, \text{ d, }-\text{CH}_2-), 3.29 (4 \text{ H}, \text{ m, }-\text{CH}_2-N), 2.73 (4 \text{ H}, \text{ m, }-\text{CH}_2-N), 2.42 (3 \text{ H}, \text{ s, Me}) \text{ ppm).} \)

\( \delta_{C}(63 \text{ MHz; CDCl}_3) 164.2, 163.7, 156.0, 132.7, 132.4, 131.2, 130.3, 129.9, 126.1, 125.6, 123.1, 117.3, 116.5, 115.0, 55.1 (2 \text{ C}), 53.0 (2 \text{ C}), 46.1, 42.2 \text{ ppm).} \)

MS (EI): m/z 335 (M+•, base peak).
Supplementary Spectra.

Fig.4 Excitation (dashed lines) and emission spectra (solid lines) of N2 and R3 inside a) the PAAm NPs (λ_{exc} = 390 nm, λ_{em} = 520 nm) and b) inside the core-shell NPs (λ_{exc} = 390 nm, λ_{em} = 520 nm). The fluorescence emission spectra of R3 (λ_{exc} = 543 nm) are represented by the red curves.

Supplementary References.