Electronic Supplementary Material (ESI) for Polymer Chemistry.

Supporting information for "Poly(N-acryloyl glycinamide) microgels as nanocatalyst platform"

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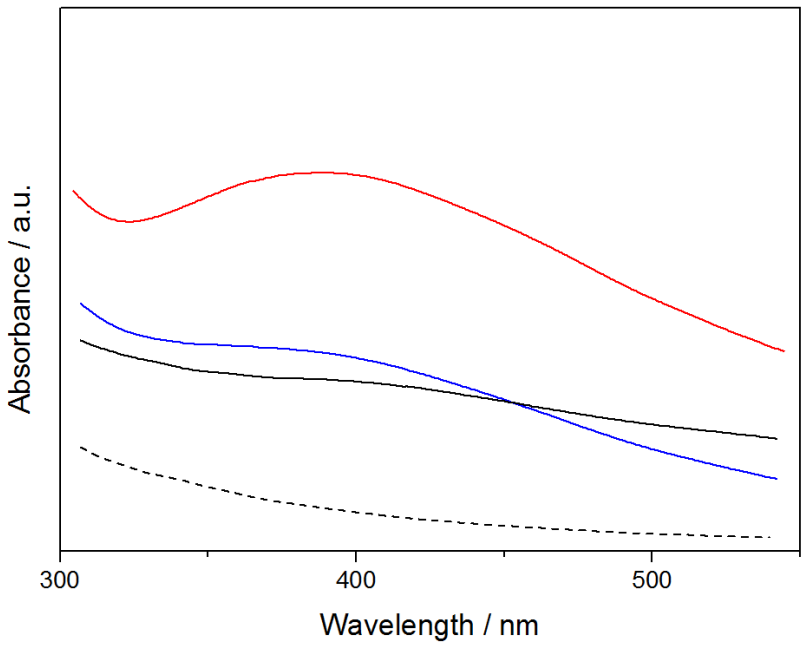
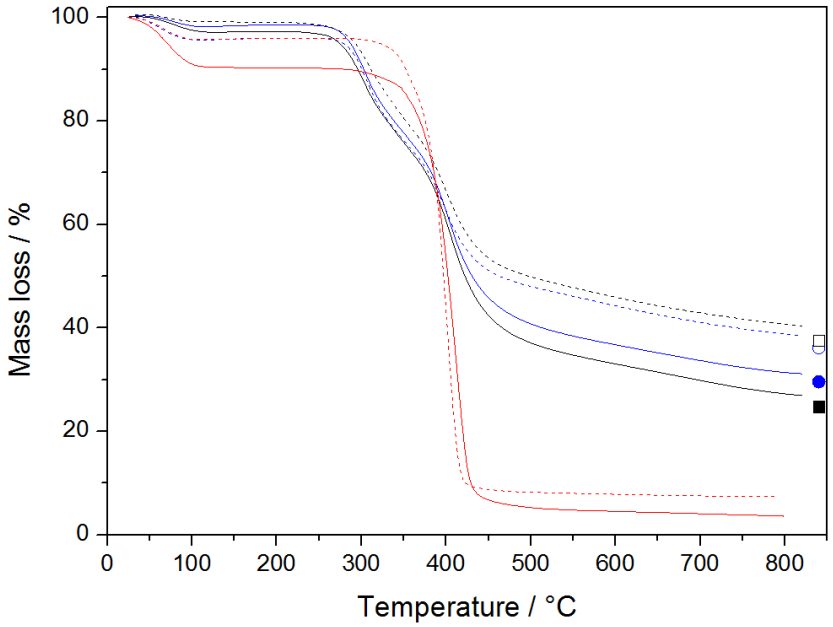
1. UV spectra of AgNP microgels at 20℃



SFigure 1. UV spectra of AgNP microgel dispersions. Ag-PNAGA-2%BIS (black), Ag-PNAGA-4%BIS (blue) and Ag-PNIPAM-2%BIS (red). UV spectrum of PNAGA-2%BIS microgel (black dashed line) as a comparison.

2. TGA analysis of microgels.

The TGA runs were made from 25°C to 800°C at 10 K/min. For the PNAGA samples experiments were made in triplicate due to the surprisingly high charred residue of the microgels and to verify full degradation the samples were kept at 800°C for two hours after the run. AgNP contents of the samples were then determined from analysis of the final masses after the run (shown by symbols for PNAGA) compared to mass after water evaporation.



SFigure 2. TGA curves of PNAGA-2%BIS (black full line) and Ag-PNAGA-2%BIS (black dashed line), PNAGA-4%BIS (blue full line) and Ag-PNAGA-4%BIS (blue dashed line) and PNIPAM-2%BIS (red full line) and Ag-PNIPAM-2%BIS (red dashed line).

3. Analysis of AgNP surface area.

For the calculation of the AgNP surface area data the data from TGA and TEM measurements was utilised. The normalised mass of Ag was taken from the residual mass left after heating. The size information was obtained by measuring the diameter of the AgNP particles from the TEM micrographs with ImageJ software. Typically at least 100 particles were manually picked from the images and they were assumed spherical. The calculation of the surface area was then performed as following using Ag-PNAGA-2%BIS as an example:

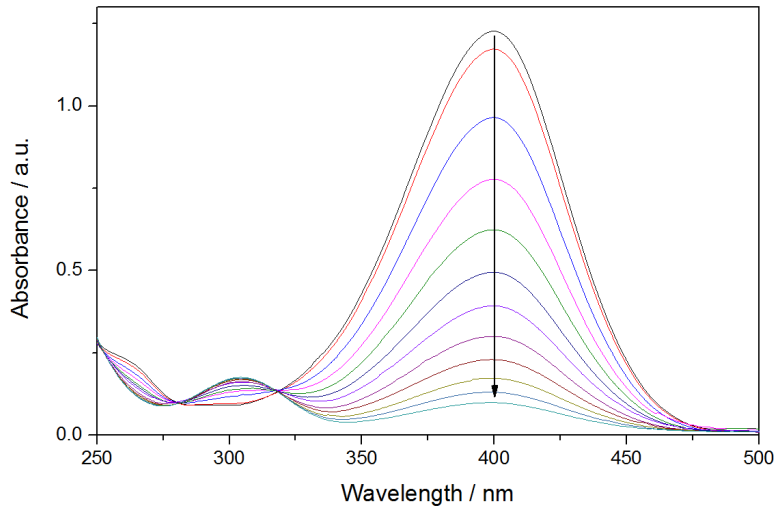
For 1 g of dry sample:

Ag content in Ag-PNAGA-2%BIS microgel according to TGA: 12.5 w-% (0.125 g)
Density of bulk Ag: 10.5 g/cm^3
Volume of AgNPs: 0.01195 cm^3 => 1.195*10^{19} nm^3
Average size of AgNPs from TEM: 6.2 nm ; Average volume 149.74 nm^3 ; Average surface area: 136.37 nm^2

Number of AgNPs: $1.195*10^{19}$ nm^3 / 149.74 nm^3 = $7.98*10^{16}$
Total surface area of AgNPs: $7.98*10^{16}$ * 136.37 nm^2 = $1.088 * 10^{19}$ nm^2 ~ $1.1 * 10^{19}$ nm^2

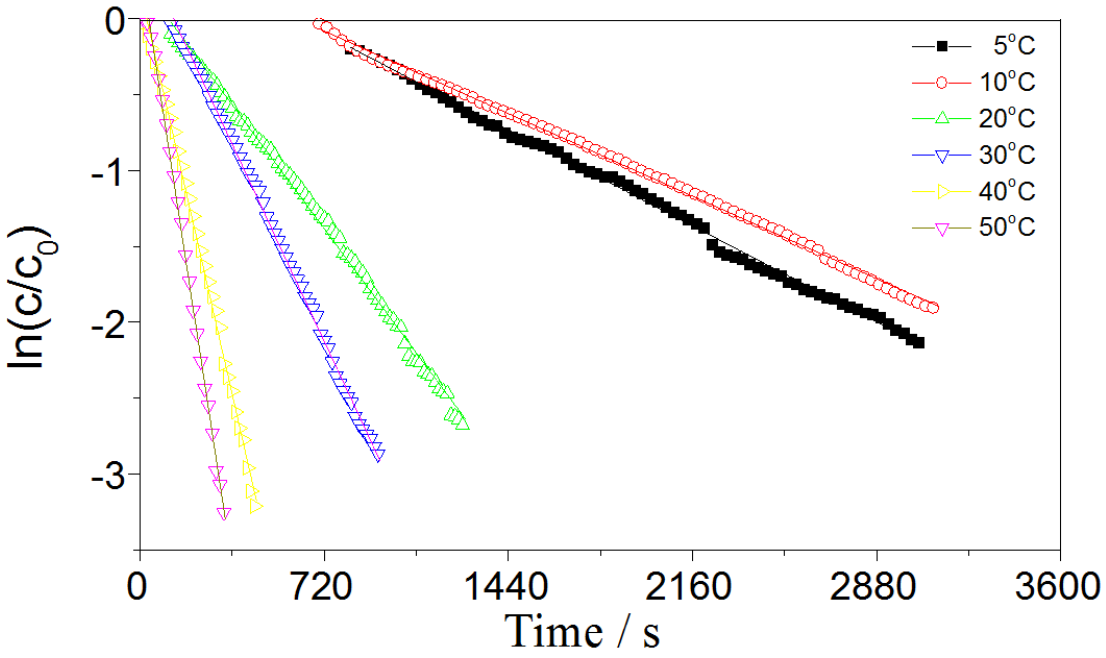
The surface area (S) of AgNPs for 13 ml injection was then calculated taking into account the microgel concentration (0.74mg/ml).

4. Nitrophenol reduction and analysis of catalysis kinetics.

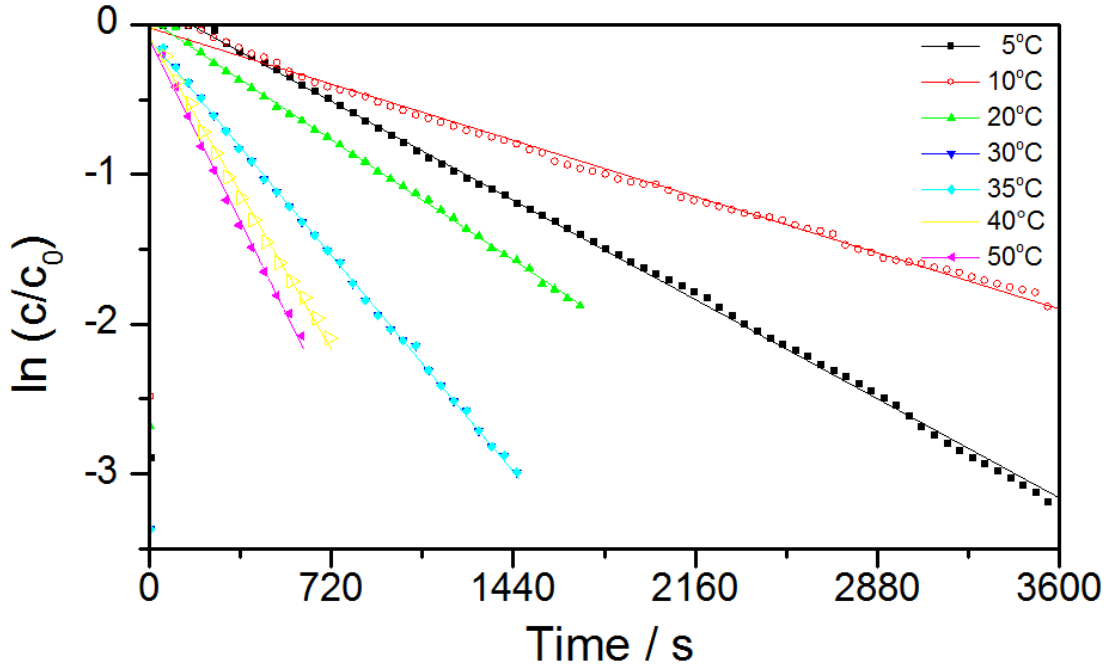


SFigure 3. UV spectra of nitrophenol reduction exemplified with insertion of 13 ml of Ag-PNAGA-2%BIS added at 22°C followed from 0 to 33 minutes.

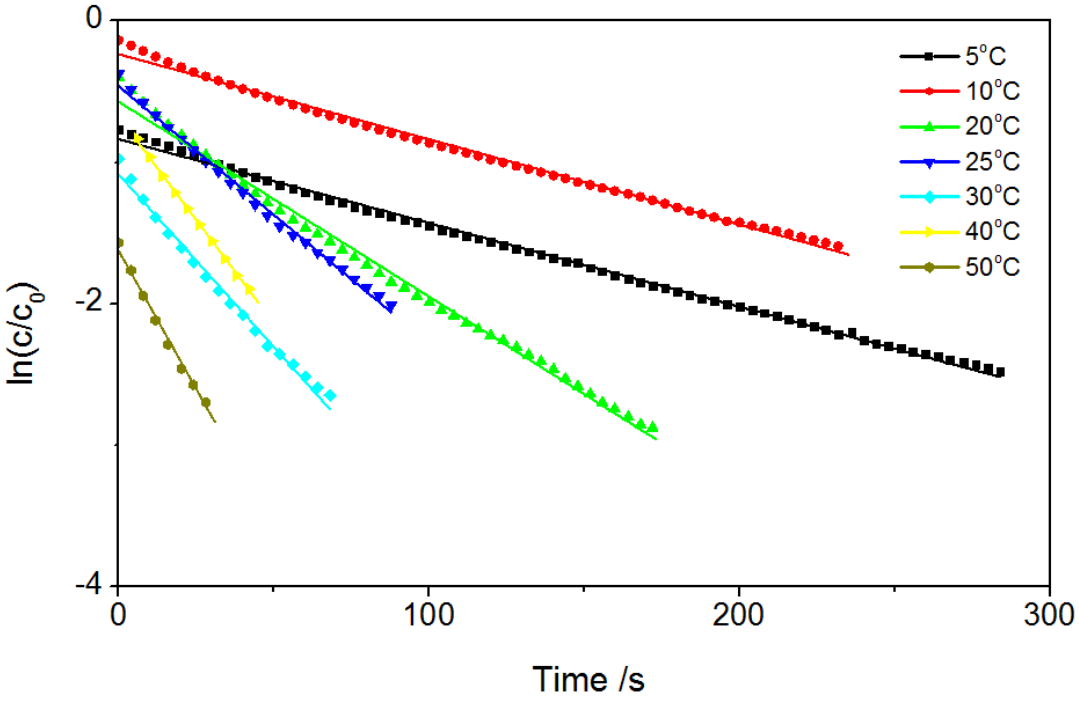
The rate constants were calculated using a pseudo-first order kinetics analysis on the data after the induction time. First the apparent rate constant, k_{app}, was determined by linear fit to the normalised absorbance data $\ln(A/A_0) = -k_{app}t$, where A_0 is the absorbance in the beginning, A the absorbance at time t. The ratio of the concentrations c_0 and c, in the beginning and at time t, respectively, were then calculated using the straightforward proportion to absorbance data, $\ln(c/c_0) = -k_{app}t$. As the apparent rate constant k_{app} is proportional to the surface area S of the metal nanoparticles present, the normalised reaction rate constant k_1 was then calculated using the surface area : $k_1 = k_{app}/S$.



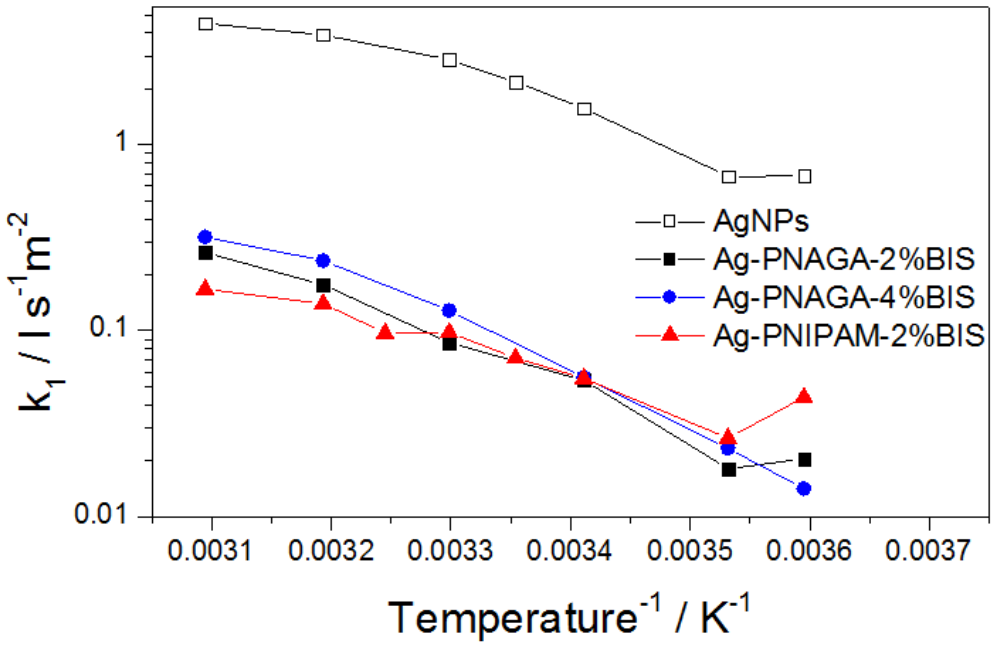
SFigure 4. Catalysis kinetics of nitrophenol with Ag-PNAGA-2%BIS microgel at different temperatures



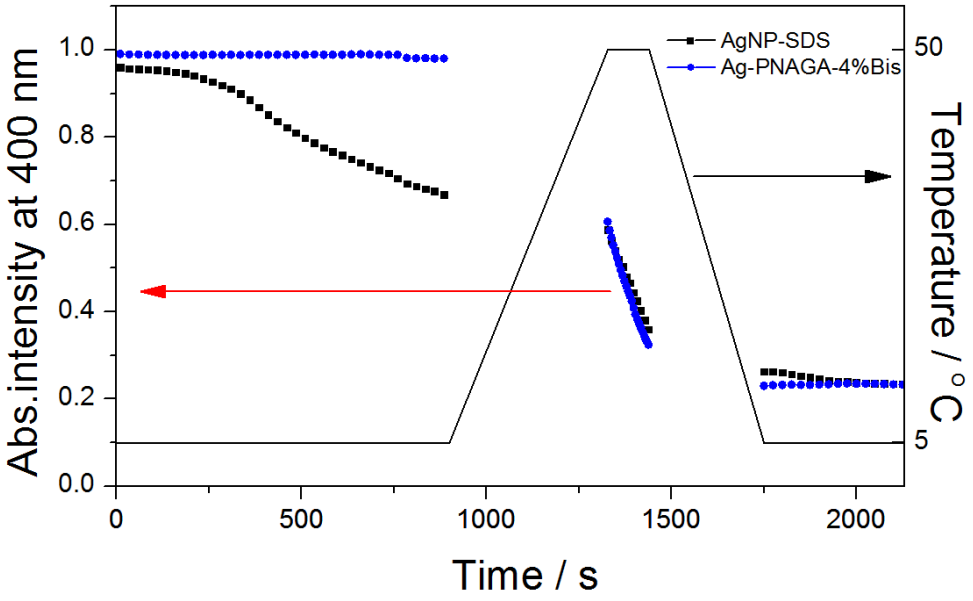
SFigure 5. Catalysis kinetics of nitrophenol reduction with Ag-PNIPAM-2%BIS microgel at different temperatures.



SFigure 6. Catalysis kinetics of nitrophenol reduction with AgNP-SDS at different temperatures.



SFigure 7. Normalised rate constants of different AgNP dispersions.



SFigure 8. Decrease of 4-nitrophenol absorbance versus time while changing the temperature with AgNP-SDS (concentration 0.0008 mg/ml) and Ag-PNAGA-4%BIS (microgel concentration 0.149 mg/ml).