Supplementary Information

1 Synthesis of spindle-type silica-coated hematite particles (SCH particles)

One liter aqueous suspension was obtained by dissolving 46.2 g of $Fe(ClO_4)_3 \cdot 6H_2O$ (Alfa Aesar), 0.649 g of H_2NaPO_4 (Fluka) and 6 g of Urea (Fluka), all used as received, in MilliQ water with a resistivity of 18.2 $M\Omega \cdot cm$. The suspension was placed in a preheated oven at 98 °C for 24 hours. The obtained particles were recovered with seven cleaning cycles comprising centrifugation at 5000 rounds per minute (rpm) for 15 minutes followed by redispersion in MilliQ water. The weight fraction of the obtained hematite particle stock suspension was determined to be 4.72 %. For the silica coating, 5 g of polyvinylpyrrolydone (PVP) were dissolved in 72 g of MilliQ water and stirred at 500 rpm in an ultrasound bath. 12.7 mL of the stock particle suspension (600 mg of hematite solid content) were added to the PVP aqueous solution. The PVP-stabilized hematite particles were cleaned from PVP excess by repeated centrifugation and redispersion, as described above. Then, the suspension was diluted by adding another 110 g of water as well as 1050 g of ethanol (EtOH) while applying ultrasound and stirring at 500 rpm. Tetramethylammonium hydroxide (TMAH, 25 % solution in water) was then diluted in 6 g of EtOH and added dropwise to the PVP-stabilized hematite particle suspension. A solution of 5.46 g tetraethylorthosilicate (TEOS), diluted in 4 ml of EtOH, was added in three equivalent portions with a waiting time of 20 minutes between two injections. Stirring and ultrasound application were continued for another hour, the sample was then stirred over night. The obtained SCH particles were recovered by centrifugation and exchanging the supernatant with EtOH. The core-shell structure was confirmed by TEM (figure S1).

2 Magnetic response of the silica-coated maghemite suspension under an external field

Small-angle X-ray scattering was carried out on a sample of silica-coated maghemite ellipsoids dispersed in water with a weight fraction of 6 %. A magnetic field of 200 mT was applied to check for the particles' alignment. Figure S2 is the resulting detector image. The observed anisotropic scattering pattern with small

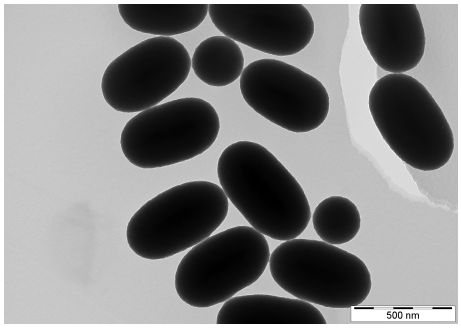

Figure S1: TEM image of SCH particles

extension along the B-field and long extension perpendicular to the field demonstrates the alignment of the particles with their long axes parallel to the field. This implies a magnetic moment along the long particle axis.

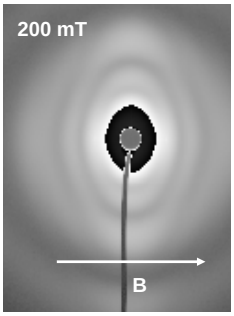

Figure S2: Detector image of a SAXS measurement of silica-coated maghemite ellipsoids suspended in water with an applied magnetic field of 200 mT pointing in the indicated direction.

In figure S3, the color inhomogeneity of the sample contained in the glass vial indicates a density gradient from low to high density towards the magnet positioned on the right side of the vial. It demonstrates the magnetic responsivity of the hybrid microgel particles.

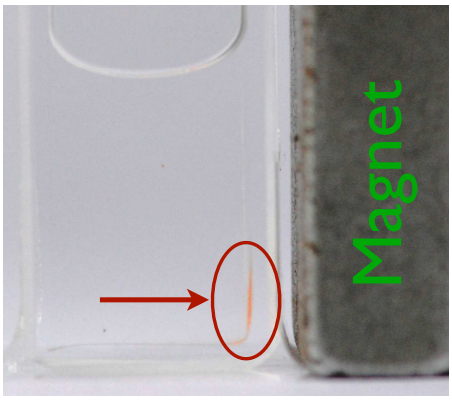

Figure S3: SCM-PNIPAM colloids in aqueous suspension isolated on the wall of the glass vial next to a permanent magnet.