Electronic Supplementary Material (ESI) for Soft Matter.
This journal is © The Royal Society of Chemistry 2015

Supporting Information

Magnetic Field Assisted Programming of Particle Shapes and Patterns

*Wenwen Xu, Yuyu Yao, John S. Klassen, Michael J. Serpe**

Department of Chemistry, University of Alberta, Edmonton, Alberta, T6G 2G2, Canada

*Corresponding author email: michael.serpe@ualberta.ca

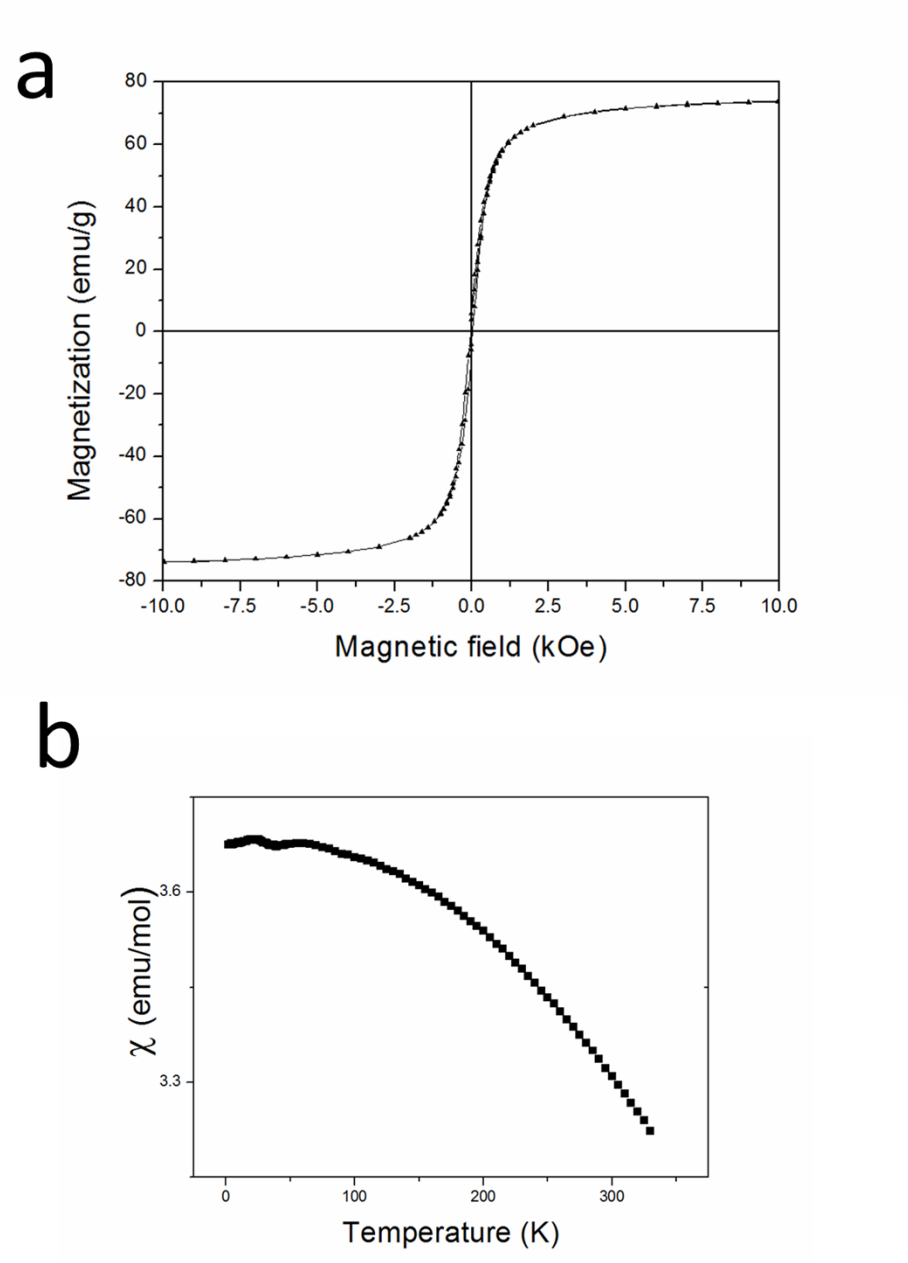


Figure S1. a) Magnetic hysteresis curves measured at room temperature for the MNPs. b) susceptibility (X) in different temperature.

The plots above show the MNPs purchased from Sigma are ferromagnetic. Accordingly, all the observations and explanations in the main text follow ferromagnetism theory.

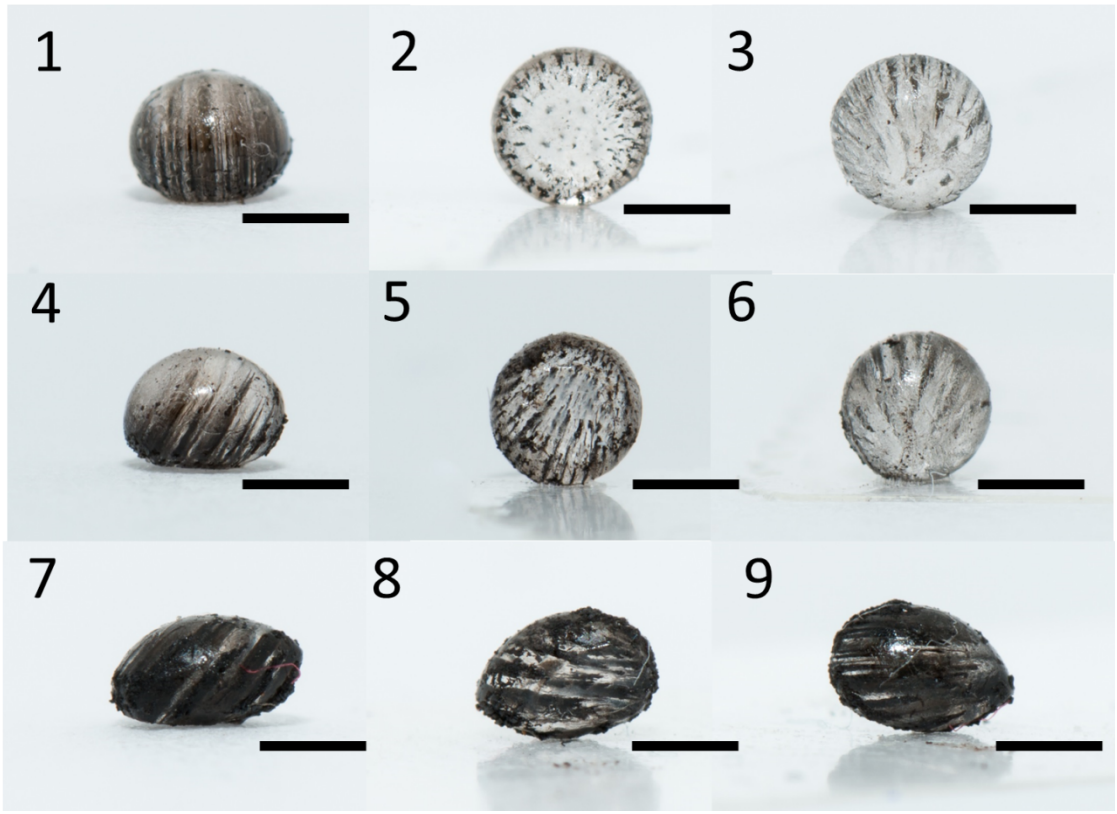


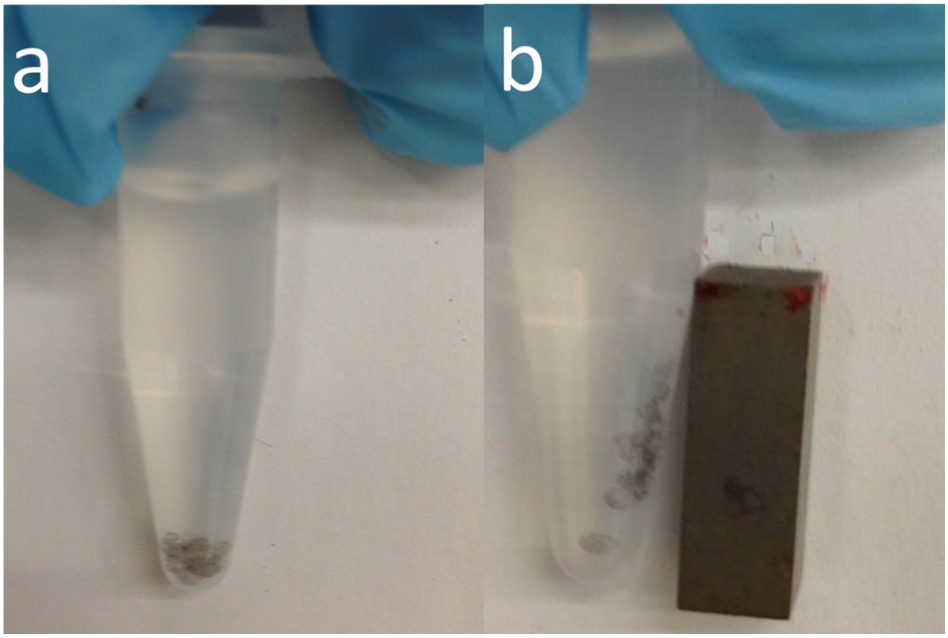
Figure S2. Photographs of the resulting particles polymerized with the magnet below the droplet at a distance of (1-3) 0.3 cm position (5,5) on the Teflon, (4-6) at a distance of 0.3 cm position (1,2) on the Teflon, and (7-9) at a distance of 0.3 cm position (1,2) on the Teflon, with the concentration of MNPs increased to 0.55 M. As can be seen, the shape of the particle depended on position, and the MNP concentration. All photographs on the left are side views, middle are bottom views, and right are top views. All scale bars in the pictures are 1mm.

Figure S3. Photographs of the resulting particles polymerized with the magnet above the droplet at a distance of (1-3) 5 cm, and (4-6) 4.5 cm. (7-9) First the magnet was <4.5 cm to make the rod structure as shown in (4-6), then moved to a distance of 5 cm. AS can be seen, the gravitational force pulls the rod back into the particle. (10-12) This is the same as (7-9), but the final distance of the magnet is 6 cm, which allows even more of the rod to enter the particle to make a stripe. All particles were synthesized at the (5,5) position. All photographs on the left are side views, middle are bottom views, and right are top views. All scale bars in the pictures are 1mm.

Figure S4. Photographs of the resulting particles polymerized with a magnet above and below the droplet in the attractive regime. (1-3) The distance between the top magnet and Petri dish is 5 cm and the distance between the bottom magnet and the Petri dish is 2 cm at position (5,5) on the Teflon. (4-6) The distance between the top magnet and Petri dish is 3.5 cm and the distance between the bottom magnet and Petri dish is 2 cm position (5,5) on the Teflon. All photographs on the left are side views, middle are bottom views, and right are top views. All scale bars in the pictures are 1mm.

Figure S5. Photographs of the resulting particles polymerized with a magnet above and below the droplet in the repulsive regime. For the photographs in (4-9, 16-18, 22-24) the left panel is a side view of the major axis, the middle panel is side view of the minor axis, and the right panel is a bottom view. Otherwise, all photographs on the left are side views, middle are bottom views, and right are top views. (1-3) The distance between the top magnet and Petri dish is 5 cm, and the distance between bottom magnet and the Petri dish is 2 cm, position (1,1) on the Teflon. (4-6) The distance between top magnet and Petri

dish is 4 cm, and the distance between bottom magnet and Petri dish is 2 cm, position (1,1) on the Teflon. (7-9) The distance between the top magnet and Petri dish is 3.5 cm, and the distance between bottom magnet and Petri dish is 2 cm, position (1,1) on the Teflon. (10-12) The distance between top magnet and Petri dish is 3 cm, and the distance between the bottom magnet and Petri dish is 2 cm, position (1,1) on the Teflon. (13-15) When the top magnet is closer than 3 cm to the Petri dish, and the distance between the bottom magnet and Petri dish is 2 cm the whole droplet floats to the surface of the TMP. (16-18) The distance between the top magnet and the Petri dish is 3 cm, and the distance between the bottom magnet and Petri dish is 1 cm, position (1,1) on the Teflon. (19-21) The distance between the top magnet and Petri dish is 5 cm, and the distance between bottom magnet and Petri dish is 0.3 cm, position (2,3) on the Teflon. (22-24) The distance between the top magnet and the Petri dish is 2.4 cm, and the distance between the bottom magnet and Petri dish is 0.3 cm, position (2,3) on the Teflon. All scale bars in the pictures are 1mm.



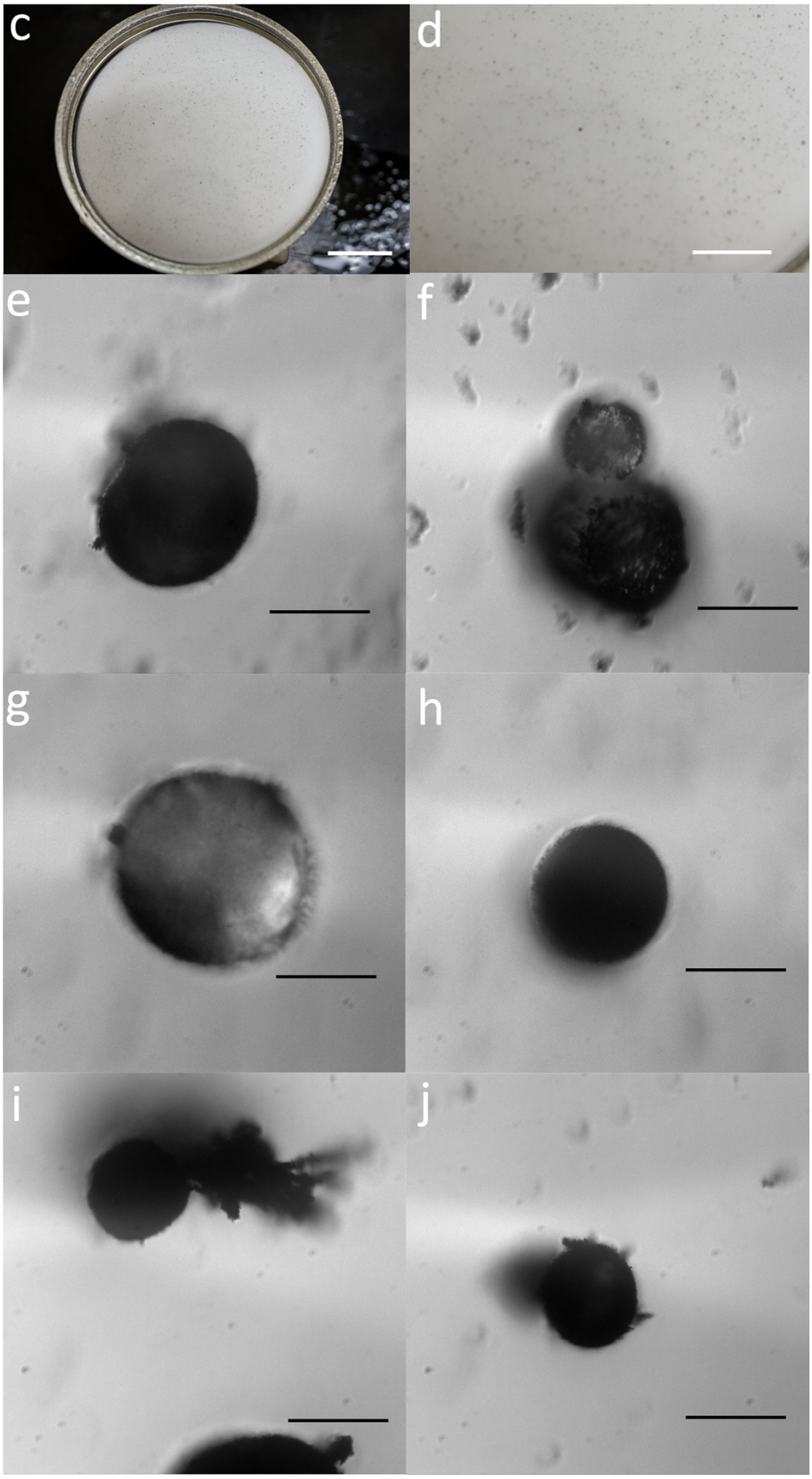

c
d
e
f
g
h
i
j

Figure S6. (a) Photograph of particles collected using the method in Figure 7(a); (b) their response to an external magnetic field; (c) droplets generated on Teflon using the method in Figure 7(b), which can be subsequently polymerized upon exposure to UV light, the scale bar is 2 cm; (d) zoom in of the Teflon film in (c), each black "dot" is an individual droplet that can be polymerized, scale bar is 1 cm; (e-j) photographs of *representative* particles generated from (c,d), scale bar is 50 μm.

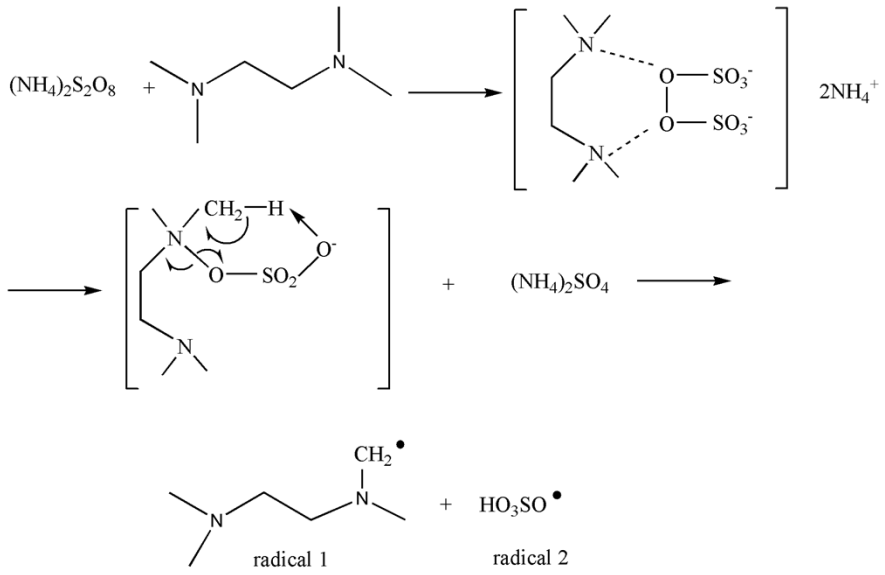


Figure S7. APS-TEMED reaction mechanism that is responsible for generating free radicals, which can subsequently initiate polymerization.

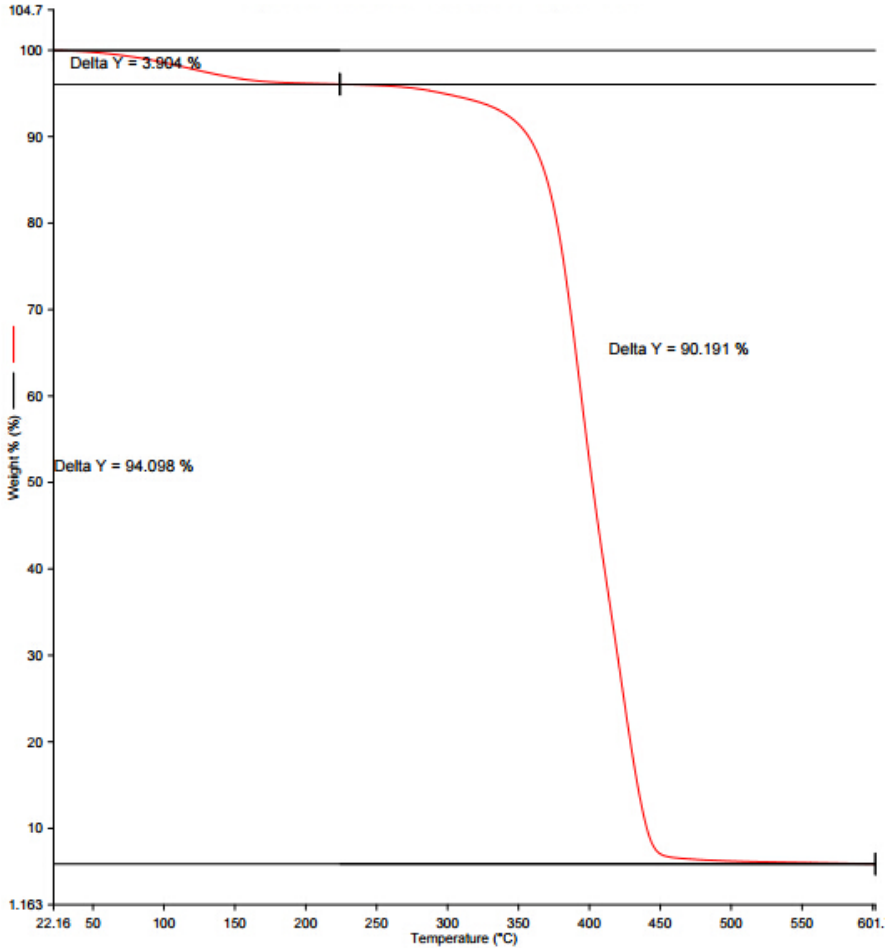


Figure S8. TGA results of the synthesized particles. The intial weight loss ~4% ("delta Y" at low temperature) is mainly due to the loss of residue water inside the polymer network. An additional ~90% is lost at high T ("delta Y" at high temperature) from the loss of polymer. From the data, we can determine that the mass of the MNPs is ~6% of the particle's total mass.