Supplementary information

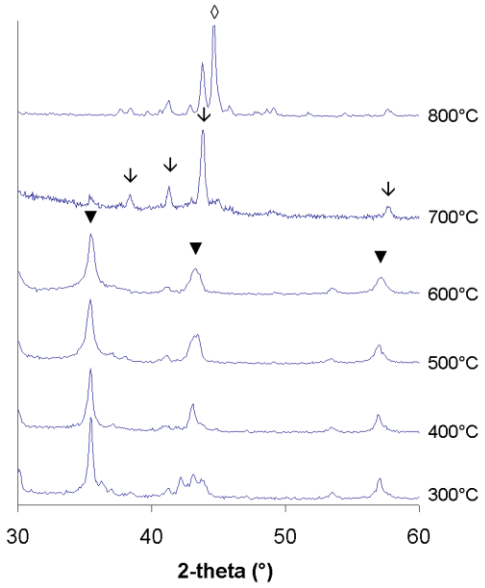

Figure S1 Full PXRD quenching profile for iron nitrate/gelatin calcined at 10 °C/min with labelled peaks corresponding to Fe_3O_4 (▼), Fe_3N (↓) and Fe (◊). The apparent peak broadening of the Fe_3O_4 possibly indicates the presence of the reduced phase FeO, as observed in other samples (e.g. Figure S2c). However, individual peaks cannot be resolved.

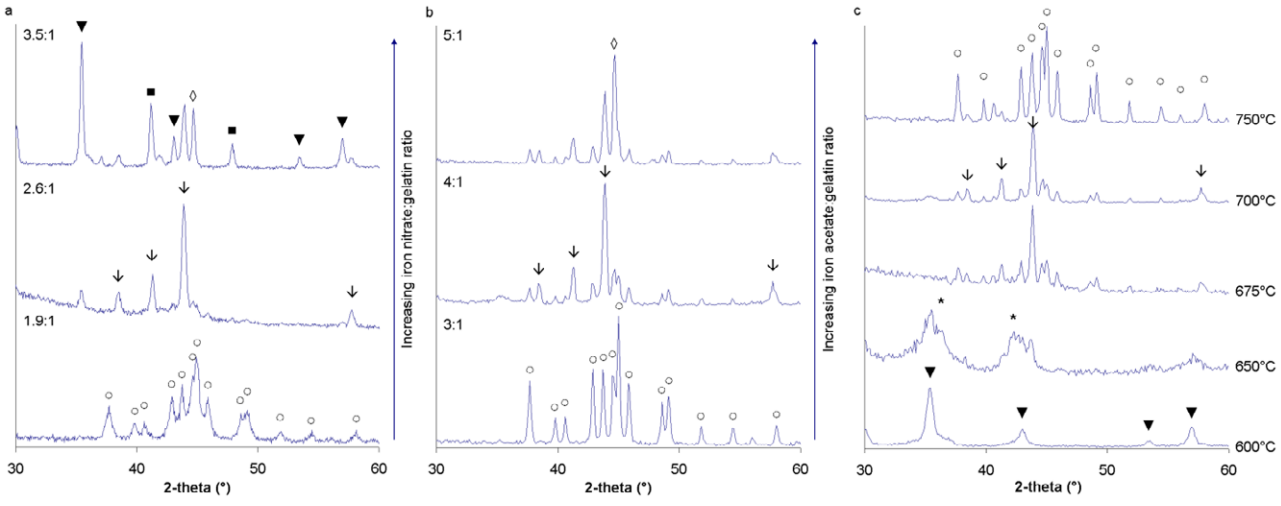

Figure S2 PXRD patterns for samples of (a) iron nitrate/gelatin and (b) iron acetate/gelatin at different metal:biopolymer ratios calcined at 10 °C/min to 700 °C. PXRD patterns for (c) samples of iron acetate/gelatin at a 4:1 mass ratio quenched at various temperatures during calcination at 10 °C/min under N_2. Labelled peaks correspond to Fe_3O_4 (▼), FeO (*), Fe_3N (↓), Fe_4N (■), Fe (◊) and Fe_3C (○). NB: additional small peaks have been left unlabelled but correspond to one of these crystalline phases.

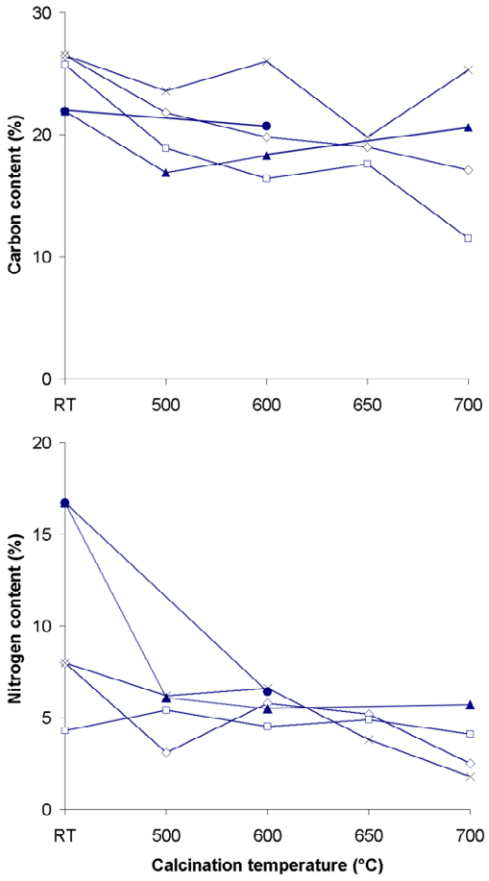

Figure S3 Percentage carbon and nitrogen content of samples quenched during calcination at 10 °C/min from iron nitrate/gelatin (▲) and iron acetate/gelatin 3:1 mass ratio (◇) and 4:1 mass ratio (□). Carbon and nitrogen content of samples calcined at 2 °C/min from iron nitrate/gelatin (●) and iron acetate/gelatin 3:1 mass ratio (×).

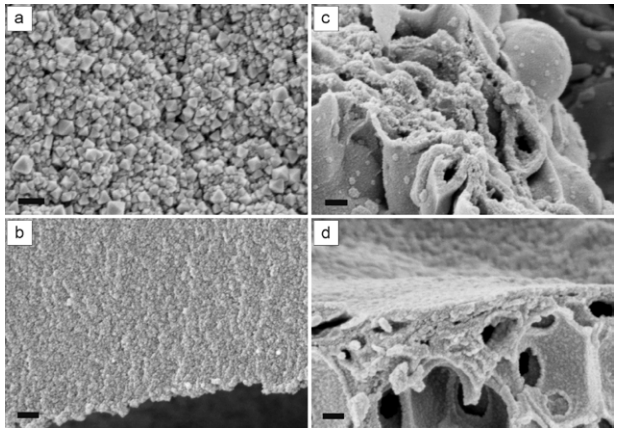

Figure S4 SEM images of samples quenched at 600 °C during synthesis from iron acetate at (a) 2 °C/min and (b) 10 °C/min and iron nitrate at (c) 2 °C/min (d) 10 °C/min. All scale bars = 200nm

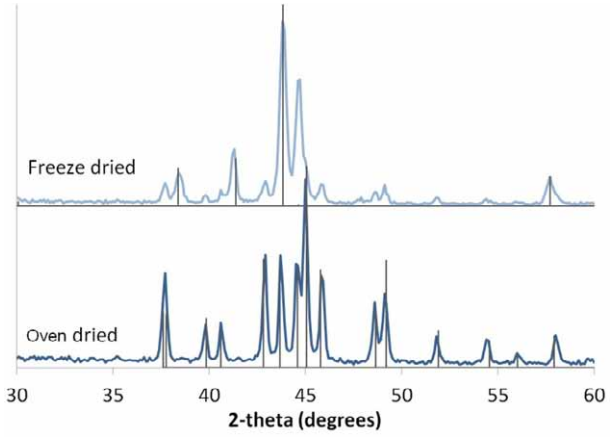

Figure S5 PXRD patterns of (a) freeze dried and (b) oven dried (dense film-like) samples of iron acetate/gelatin calcined to 700°C.

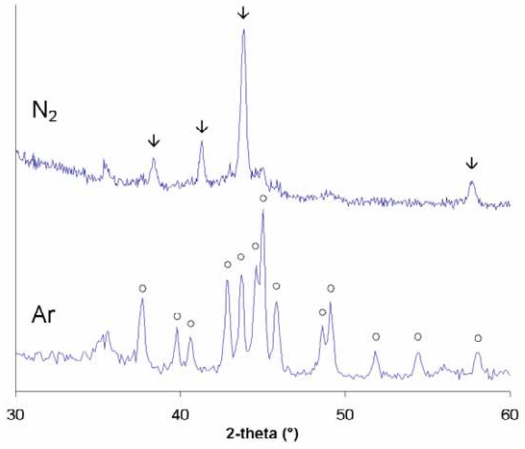

Figure S6 PXRD patterns for identical samples of iron nitrate/gelatin calcined at 10 °C/minute to 700 °C with no dwell under nitrogen and argon atmospheres. Labelled peaks correspond to Fe_3C (○) and Fe_3N (↓).

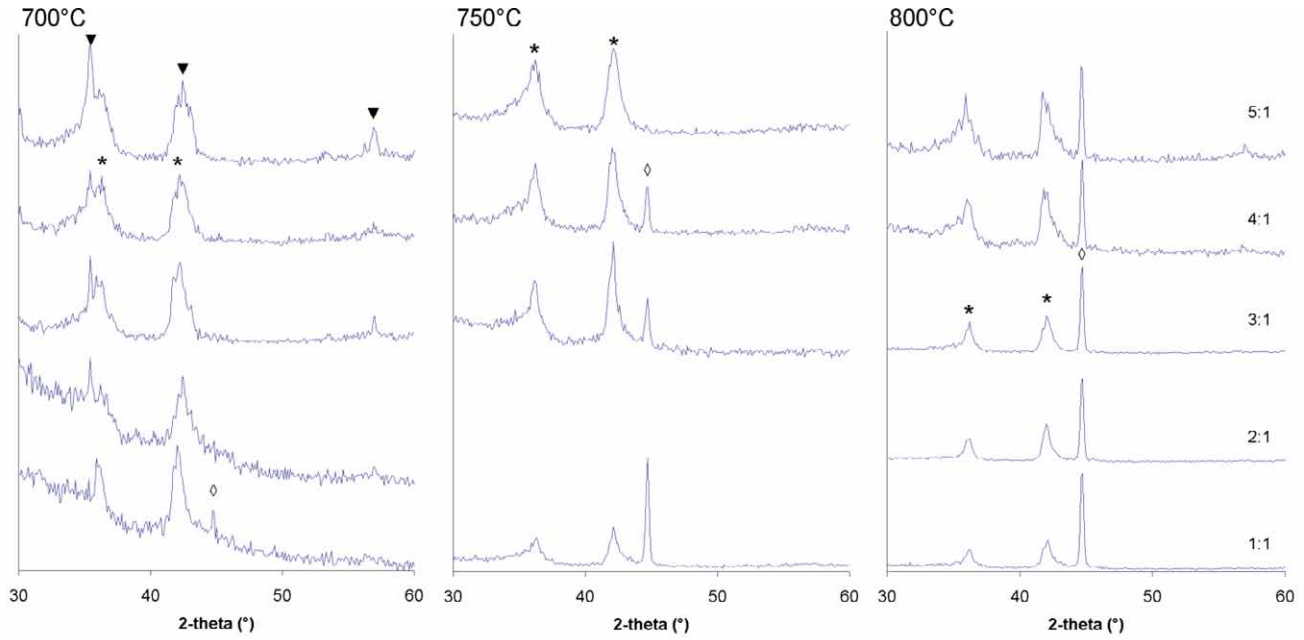

Figure S7 Samples of iron acetate/agar (mass ratio $Fe(OAc)_2$:agar from 1:1 to 5:1) calcined at 10 °C/min under nitrogen to various temperatures with no dwell time. Labelled peaks correspond to Fe_3O_4 (▼), FeO (*) and Fe (◊).

Characterization Techniques

PXRD was carried out on a Bruker D8 Advance diffractometer (Copper K-alpha radiation) equipped with a LynxEye detector. Samples for scanning electron microscopy (SEM) were dispersed on carbon adhesive pads, coated with platinum/palladium and analyzed using a Field Emission JEOL JSM-7500F SEM. Transmission electron microscopy (TEM) images were taken on a Zeiss EM 912 Ω operated at an acceleration voltage of 120 kV. Samples were ground, suspended in ethanol and sonicated for 2 minutes in an ultrasonic bath. One drop of this suspension was put on carbon-coated copper grid and left in air to dry.

For catalytic testing, we used pure ammonia in a quarz tube reactor with inner and outer tube. The inner tube contains a quarz frit with a diameter of 5.5 mm on which the material is placed. The height of the material is between 2 and 5 mm and we used 25mg. The flow rate was 15000 cm^3 g^{-1} catalyst hr^{-1}.