Theoretical characterization and synthesis of gelatin based magnetic hydrogels

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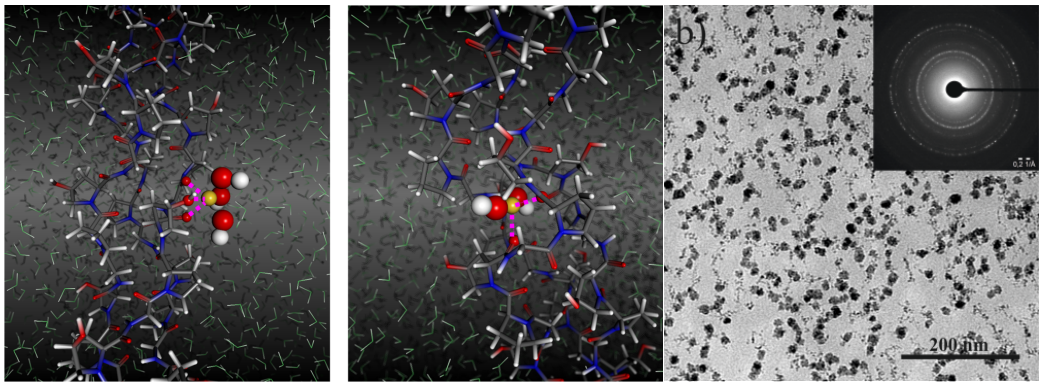
Figure 1: (left) Representative structure for $FeIII(OH)_3$ coordination by collagen. Note that three carbonyl/hydroxyl groups are providing O··Fe salt brigdes via one short (2.3 Å) and two weaker (2.6Å) contacts. (middle) $FeII(OH)_2$ cluster coordination by collagen leading to distorted/incomplete octahedral coordination of FeII (the number of coordinating water molecules from the solvent varies from 0 to 2). Atom colors: Fe (yellow), O (red / green for solvent), H (white), N(blue) and C(grey). (right) TEM image of ultramicro-cuts of an embedded ferrogel at 10 wt% gelatin concentration after 6 reaction cycles (RC) at different magnifications.



We report an easy synthesis of ferrogels based on magnetite synthesis inside a thermoreversible gelatin gel matrix. The structure of the gelatin gel and the magnetite nanoparticles are characterized by X-ray diffraction, electron microscopy and molecular simulations. The simulation studies show the attractive interaction between the gelatin / collagen triple helix and the Fe^{2+} / Fe^{3+} ions and also reveal that collagen is a magnetite nucleator. We demonstrate the response and deformation of the gel in a magnetic field, which suggests that our gels may find applications as biocompatible actuators or switches.

[1] D.Zahn, O.Hochrein, A.Kawska, J.Brickmann, R.Kniep, *J. Mater. Sci.*, **2007**, 42, 8966-8973.

[2] M. Helminger, B.H. Wu, T. Kollmann, D. Benke, D. Schwahn, V. Pipich, D. Faivre, D. Zahn, H. Coelfen „Synthesis and Characterization of gelatin based magnetic hydrogels" *Adv.Funct.Mater.*, in press.