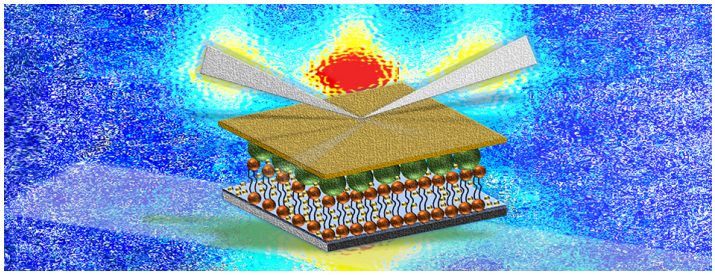

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Impact of Coating Type on Structure and Magnetic Properties of Biocompatible Iron Oxide Nanoparticles: Insights into Cluster Organization and Oxidation Behaviour

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Superparamagnetic iron oxide nanoparticles (SPIONs) are promising nano-vehicles for biomedical applications such as drug delivery, imaging, and magnetic hyperthermia. However, one of the limitations of these systems is their tendency to agglomerate, which has a direct impact on the efficiency of their performance. One way to overcome this limitation is to apply a coating during synthesis. In this work, we have investigated the effect of three biocompatible coatings on controlling the agglomeration of iron oxide nanoparticles. The biocompatible coatings used are sodium citrate, (3-aminopropyl)triethoxysilane (APTES), and dextran. The structural and magnetic properties of the coated nanoparticles are characterized using various experimental techniques, including cryogenic transmission electron microscopy (cryo-TEM), magnetometry, Mössbauer spectroscopy, and small-angle X-ray and neutron scattering. The results show that the coatings effectively stabilize the nanoparticles, and lead to clusters of different sizes which then modifies their magnetic behaviour due to magnetic inter-particle interactions. We also investigated the oxidation kinetics of the nanoparticles prepared with the various coating materials as a function of time to characterize the oxidation behaviour and stability. This research provides valuable insights into the design of an optimized nanoparticle functionalization strategy for biomedical applications.

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