Next Generation of Magnetic Nanoparticles for Clinical Applications

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Abstract - Cancer is still a leading cause of disease worldwide. Magnetic nanoparticles offers an exciting new alternative treatment, with local heating of affected areas allows to eliminate the side effect of current radio-or chemotherapy. The most cutting edge research has recently focused on the combination of heat treatment with traditional cancer drugs. That synergistic effect with enhance the treatment efficacy of both hyperthermia and drugs. However, the currently available MNPs namely iron oxide are sub-optimal in terms of their physical and biochemical properties. They have lower saturation magnetisation and often are not well biofunctionalised for specific biological target. In this presentation, novel class of MNPs with different size, shape (cube, octopods, rods, multipods, star), chemical composition (e.g., metallic Co, alloy FePt, trimetallic FePtPd, etc..;), coating and surface chemistry have been fabricated using wet chemical methods. Multifunctional/hybrid MNPs with noble metal Au and semiconductor quantum dots CdSe were also synthesised. Magnetic nanoparticles could also be used to track neural stem cells after a transplant in order to monitor how the cells heal spinal injuries or tracking of engrafted pancreatic islets for transplantation:

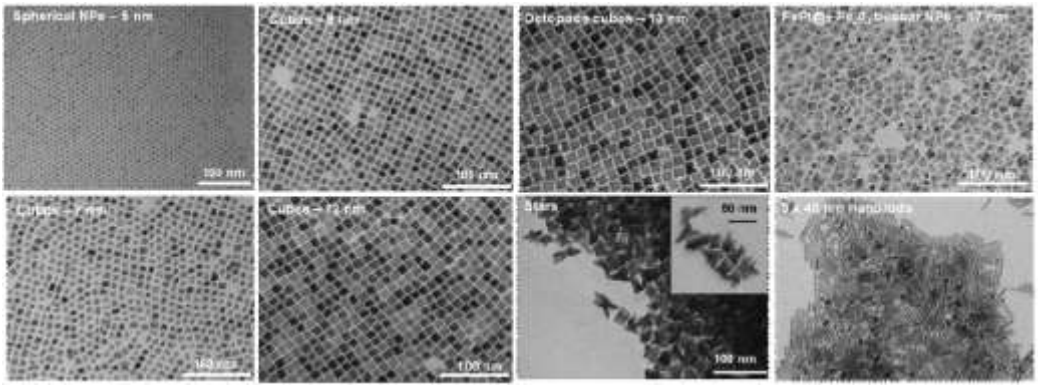

Fig 1: Tunable shapes of magnetic nanoparticles: Fe-Pt, Fe-Pd and Fe-Pt-Pd alloys.

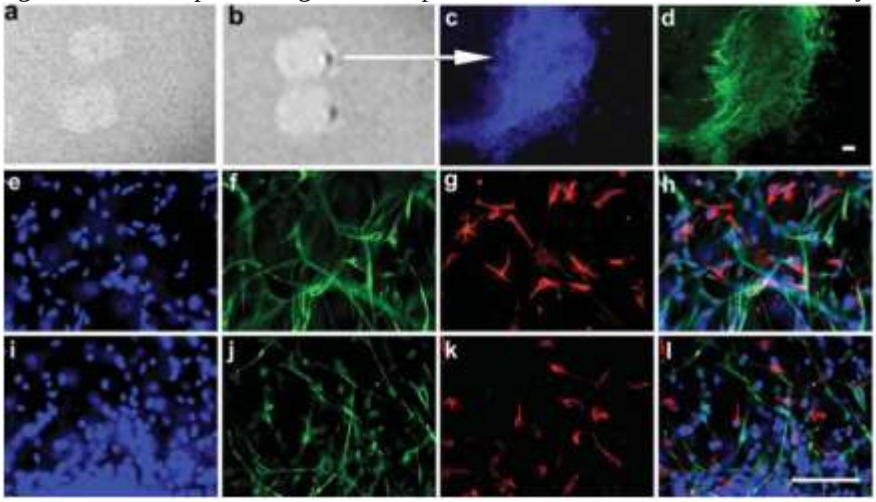

Fig 2. CoPt-labeled NSCs detected by MRI after transplantation into rat spinal cord slices.

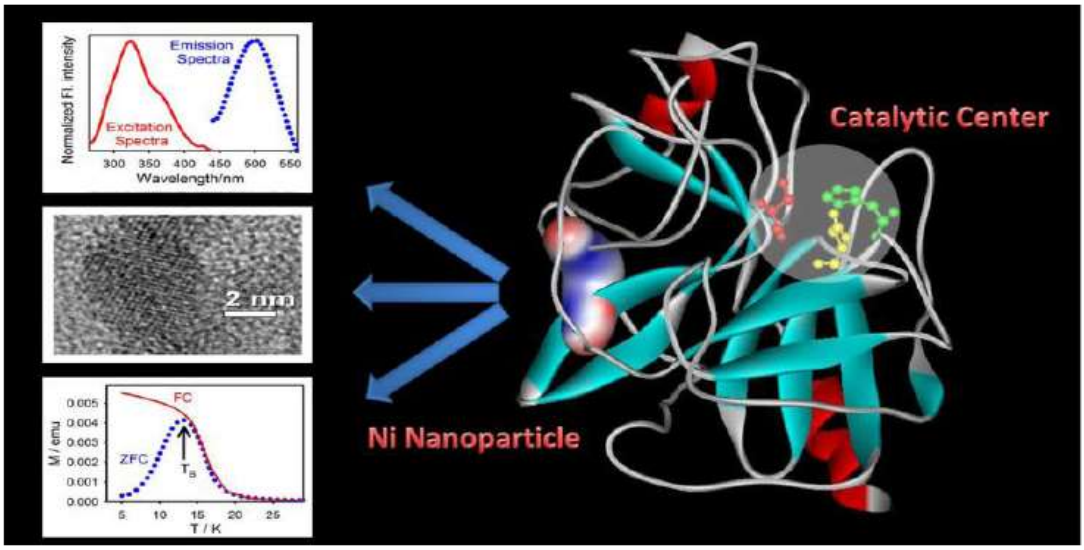

Fig 3. Superparamagnetic Fluorescent Nickel-Enzyme Nanobioconjugates

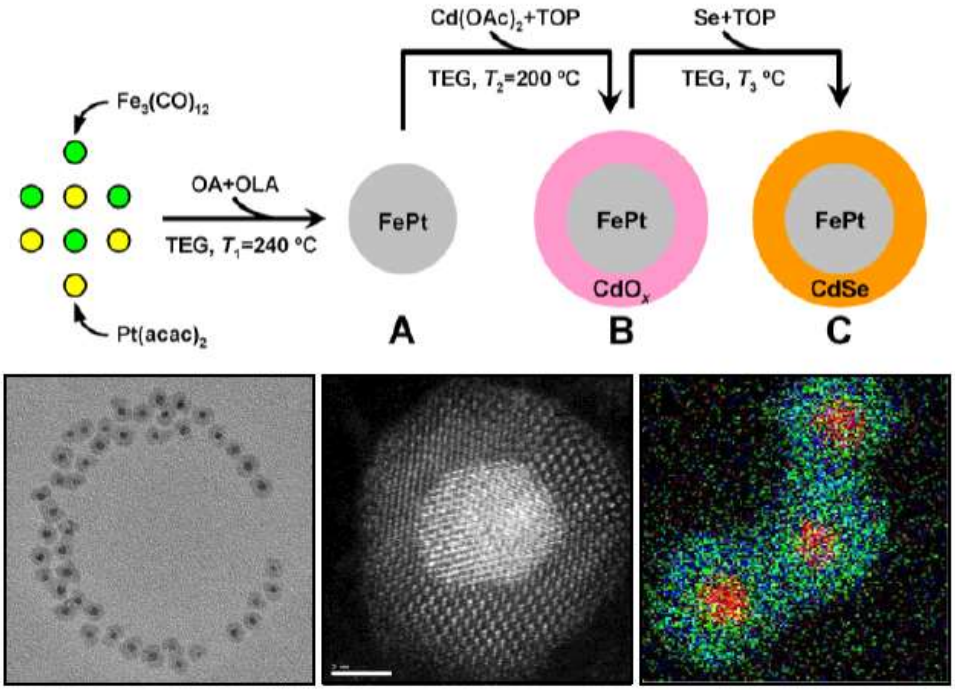

Fig 4. Core@Shell Structure of FePt@CdSe Nanoparticles.

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