Synthesis of NiPd Nanoparticles
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Abstract
Magnetic Fluid Hyperthermia (MFH) is a potential therapy for cancer treatment, where magnetic beads are localized in cancerous tissue and heated by an alternating magnetic field, which destroys the tissue. Self-regulated MFH uses magnetic nanoparticles with a Curie temperature equal to the therapeutic temperature (typically 45°C). Such particles self-control the temperature within the cancerous tissue.

Desirable attributes of nanoparticles for MFH3
• Monodisperse size
• Easy functionalization of particle’s surface
• Good dispersability of particles for functionalization and application

Synthesis of NiPd nanoparticles by Son et al.’s procedure
2 ml Triocyl phosphine (TOP)+0.328 mmol Nickel acetylacetonate + 0.328 mmole Palladium acetylacetonate heated to 80°C under N2 +
7 ml Oleyl amine heated to the injection temperature (typically ~250°C) under N2
Inject TOP + Ni and Pd precursors into oleyl amine and maintain the injection temperature for 30 minutes
Cool to room temperature, precipitate particles with ethanol and redisperse with hexane. Repeat cleaning and store particles in Hexane

Effect of changing the phosphine ligand
• Compositions determined by SEM-EDX
• XRD confirmed the formation of fcc NiPd nanoparticles with a crystallite size of 2.5 nm
• TOP and TBP gave the same size nanoparticles
• Particles made in TBP had more Pd

• A typical TEM image of NiPd nanoparticles either using TOP or TBP, indicating a size of 2.5 nm

Modifying Son et al.’s procedure
• Composition of particles can be varied by changing
  – Ni to Pd precursor ratio
  – injection temperature
• Based on a recent study by Park et al.1 on Ni nanoparticles, size of NiPd nanoparticles may be varied by using different phosphine ligands
  – Using Tributyl phosphine (TBP) is expected to give larger particles than TOP

Effect of Ni/Pd ratio and injection temperature

Conclusions and Future work
• Composition of NiPd nanoparticles could be changed by varying the Ni/Pd ratio and the injection temperature
• From preliminary experiments, the size of NiPd nanoparticles could not be tuned by changing the phosphine ligand
• M-H loops measured by AGM indicate that NiPd nanoparticles have coercivities close to 100 Oe at room temperature
• Further experiments need to be done to tune the size of NiPd nanoparticles
• Curie temperature measurements need to be performed

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