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Fabrication of Iron Oxide Nanoparticle Monolayers by Electrophoretic Deposition[1] ALEX KREJCI, ISABEL GONZALO-JUAN, JAMES DICKERSON, Department of Physics and Astronomy, Vanderbilt University — Magnetic nanoparticle (NP) films are potentially useful in a variety of applications, such as magnetic storage media and ultra-strong permanent magnets. Monolayers of magnetic NPs are specifically interesting as the monolayer geometry maximizes film interactions with dissimilar materials below and above the monolayer. However, many potential commercial and industrial applications of NP films rely on fabrication techniques that are facile, rapid, and site-selective which create homogenous, densely packed, defect-free thin films. Electrophoretic deposition (EPD) is a technique for forming thin films that meets all of these criteria. This work shows, for the first time, EPD's utility in forming monolayers of magnetic NPs. Iron oxide NPs (∼14nm) have been synthesized using a solution phase synthesis technique. Repeated centrifugation of the particles prepares the NPs for EPD. The particles are then deposited onto silicon substrates with EPD using dc electric fields. Analysis of the films using scanning electron microscopy and atomic force microscopy shows the particles deposit as NP monolayers. The monolayer density and deposition rate are controlled by varying the suspension concentration and the deposition time. Future research will focus on creating long-range order within the monolayers.

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