In-situ TEM Study on the Phase Transformation in Fe-Pt Alloyed Thin Films by Ion Irradiation and Annealing

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Introduction

- Sub 10-nm granular morphologies are critical for next generation magnetic recording. As the volume of a grain decreases, it becomes susceptible to magnetic reversal (superparamagnetism). Materials with a large magnetic anisotropy, K, can help to overcome superparamagnetism for magnetic storage.

- Fe-Pt intermetallics are candidate materials for high K materials. Upon growth of these films, they adopt a metastable A1 phase (disordered fcc). Annealing chemically orders the A1 phase into the desired intermetallic phase, but causes grain growth and the loss of small granular bit sizes.

- We propose to use ion irradiation as a mechanism to order Fe-Pt alloyed films while maintaining a small grain size.

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Conclusion

- Synthesized Fe 25 at.%-Pt films via co-sputtering.
- After ~9 x 10¹³ Kr⁺ ions the Fe-Pt alloy crystallizes.
- Through a series of annealing treatments and ion irradiation dosages, more phase transformations are evident (future work).
- Successfully documented microstructure changes under ion irradiation.

Future Work

- Perform magnetic measurements on irradiated samples.
- Analyze data from other annealing and irradiation treatments performed at Argonne.
- Vary the energy of the ion beam and the type of ion during irradiation

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