Studying Thermal Roughness in Induction Heated Iron Nanoparticle Laced Sorbitol Films

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Background/Relevance

- Induction heating of nanoparticles can provide more precise control over the heating of a substance, as well as quicker heating.
- Induction heating of nanoparticles has a wide variety of applications, from potential cancer treatment to improved efficiency of chemical reactions.

Innovation

- The thermal roughness of induction heated nanoparticles has received little study.
- Understanding the relationship between nanoparticle distribution would further other developments in the field.

Approach

- Using MATLAB, colormaps can be created of thermal roughness from IR footage.

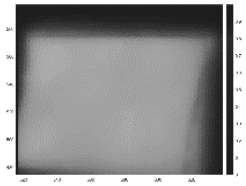

Fig. 1 – Grayscale image of sample's thermal roughness

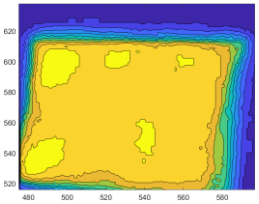

Fig. 2 – Colormapped image of sample's thermal roughness

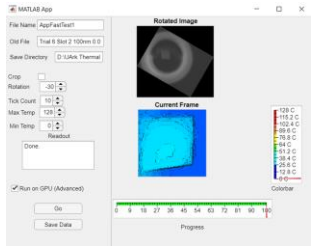

Fig. 3 – Screenshot of the MATLAB program I wrote for this project

Key Results

- Some samples showed unexpected thermal roughness
- These samples possessed at least one 'peak' where the temperature was at least 10 C above the mean of the sample
- These peaks were only present during the heating process.

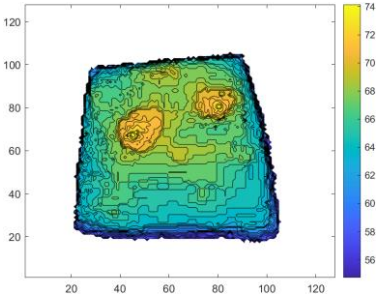

Fig. 4 – Thermal footage of a sample filtered for background noise to better display the roughness of the peaks

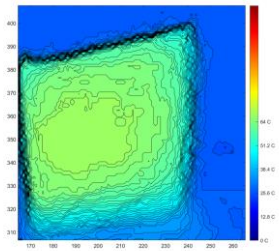

Fig. 5- Thermal footage of a thermally smooth sample for comparison.

Conclusions

- Since the peaks were only present during heating, it was concluded that they are due to nanoparticle distribution
- Spin casting processes are likely to produce better thin films for study than drop casting, but our procedures need work
- Future work is likely to involve determining causes for this thermal roughness and developing better methods of creating thin films via spin cast.

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