Nanoscale Surface Morphology Induced by Poor Solvents on Glassy Polymer Films

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Outline

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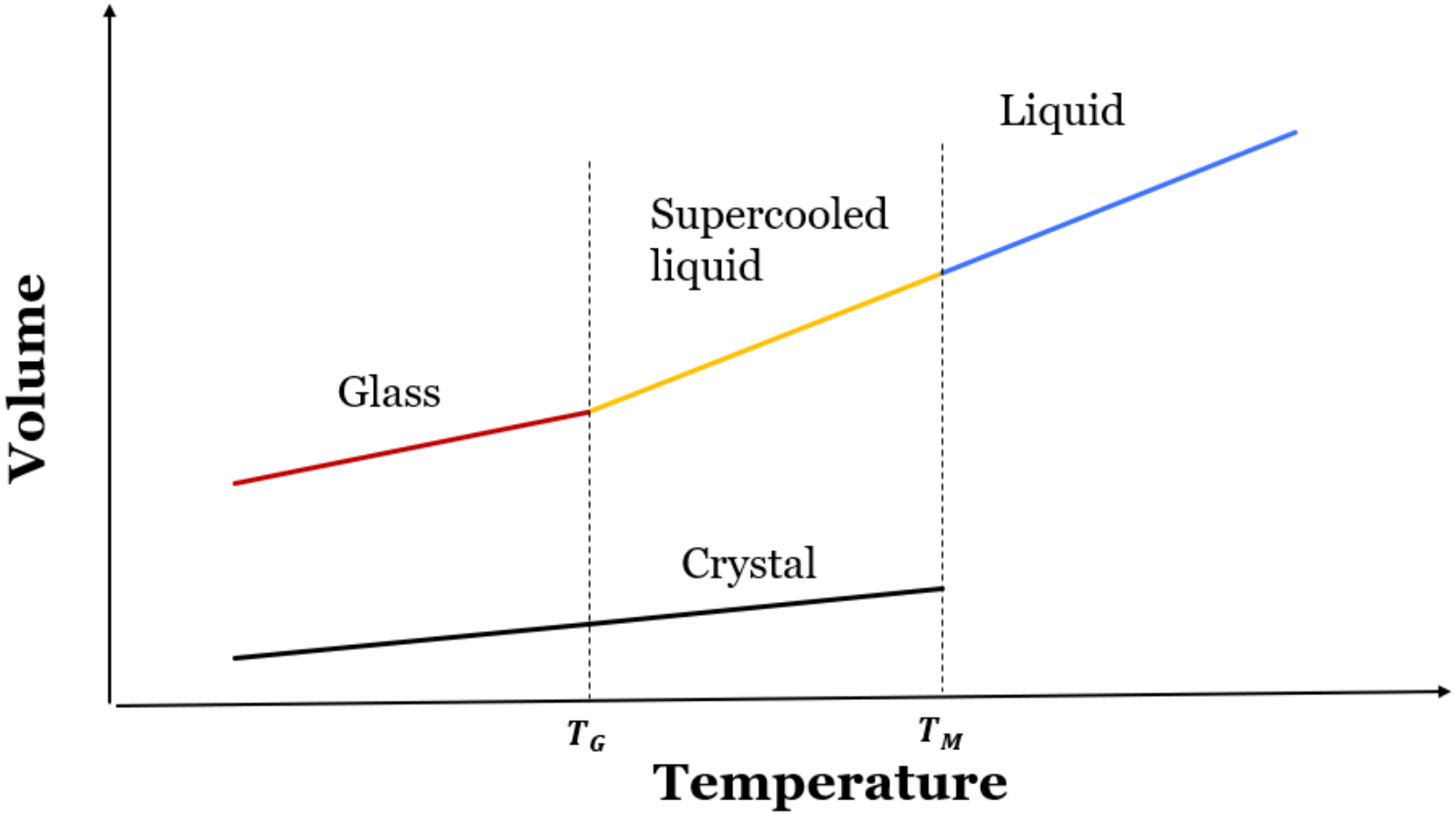
Glassy Polymers



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Solvents

Good Solvent: Fully dissolve polymer thin films

→ *eg. Toluene for Polystyrene*

Poor Solvent: No lasting effect on the surface of polymer thin films

→ *eg. Heptane for Polystyrene*

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Motivation

What if poor solvents which are used in nanotech processes have an impact on the material surface?

Research Question

Investigate the surface morphology of glassy polymer thin films after exposure to poor solvents through the use of atomic force microscopy

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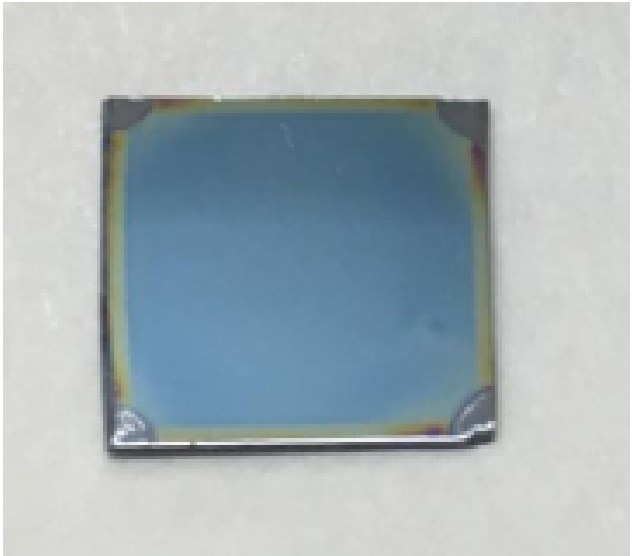
Methods: Thin Film Preparation

Polystyrene (PS) thin films were produced through spin casting onto a silicon substrate

→ *2% PS solution was spin cast at 1500 rpm, resulting in films of thickness range 130-150 nm*

→ *Number average molecular weights ranging from 44 600 g/mol to 545 000 g/mol*



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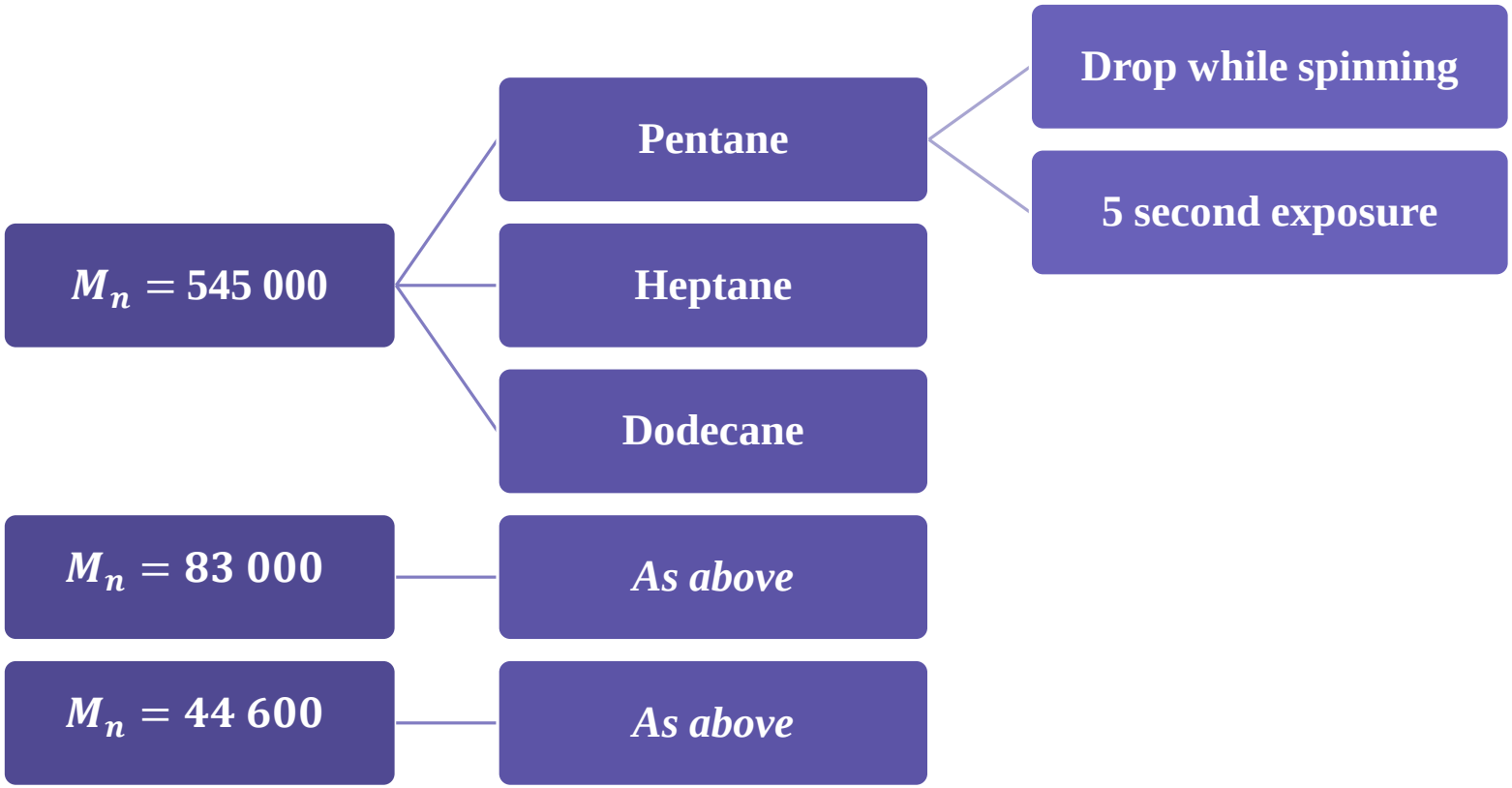
Methods: Solvent Exposure



Methods: Morphology

→ *Surface morphology measured by atomic force microscopy and radial power spectral density function (PSDF)*

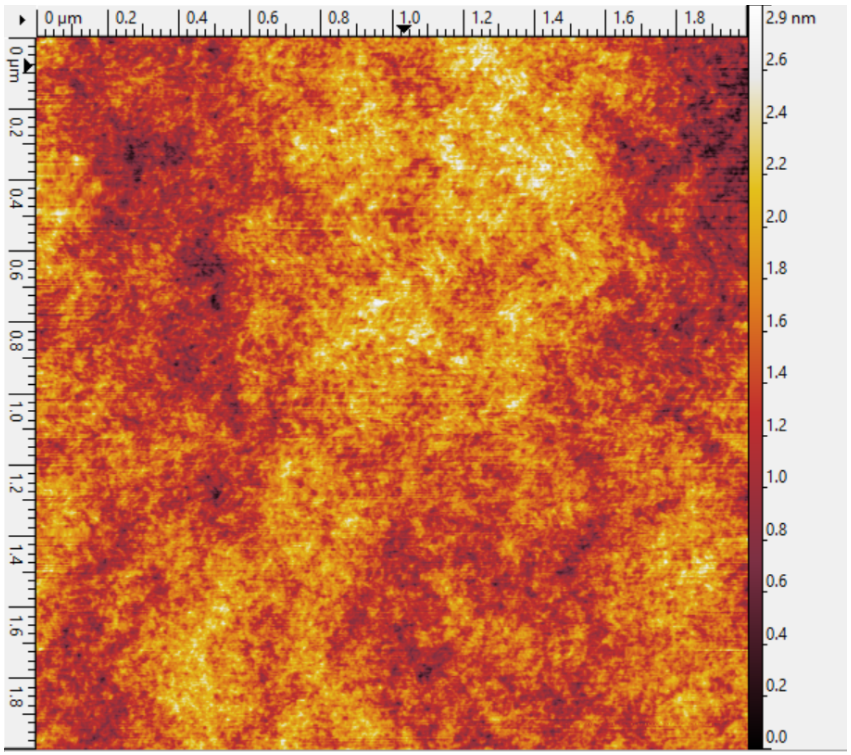


Figure: Untreated Film

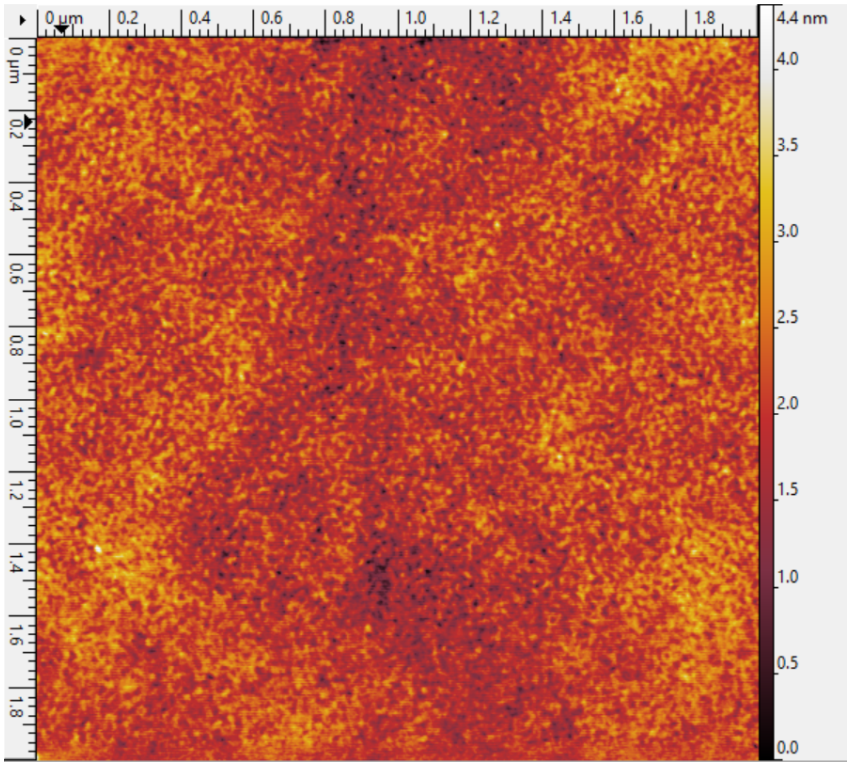


Figure: Treated Film

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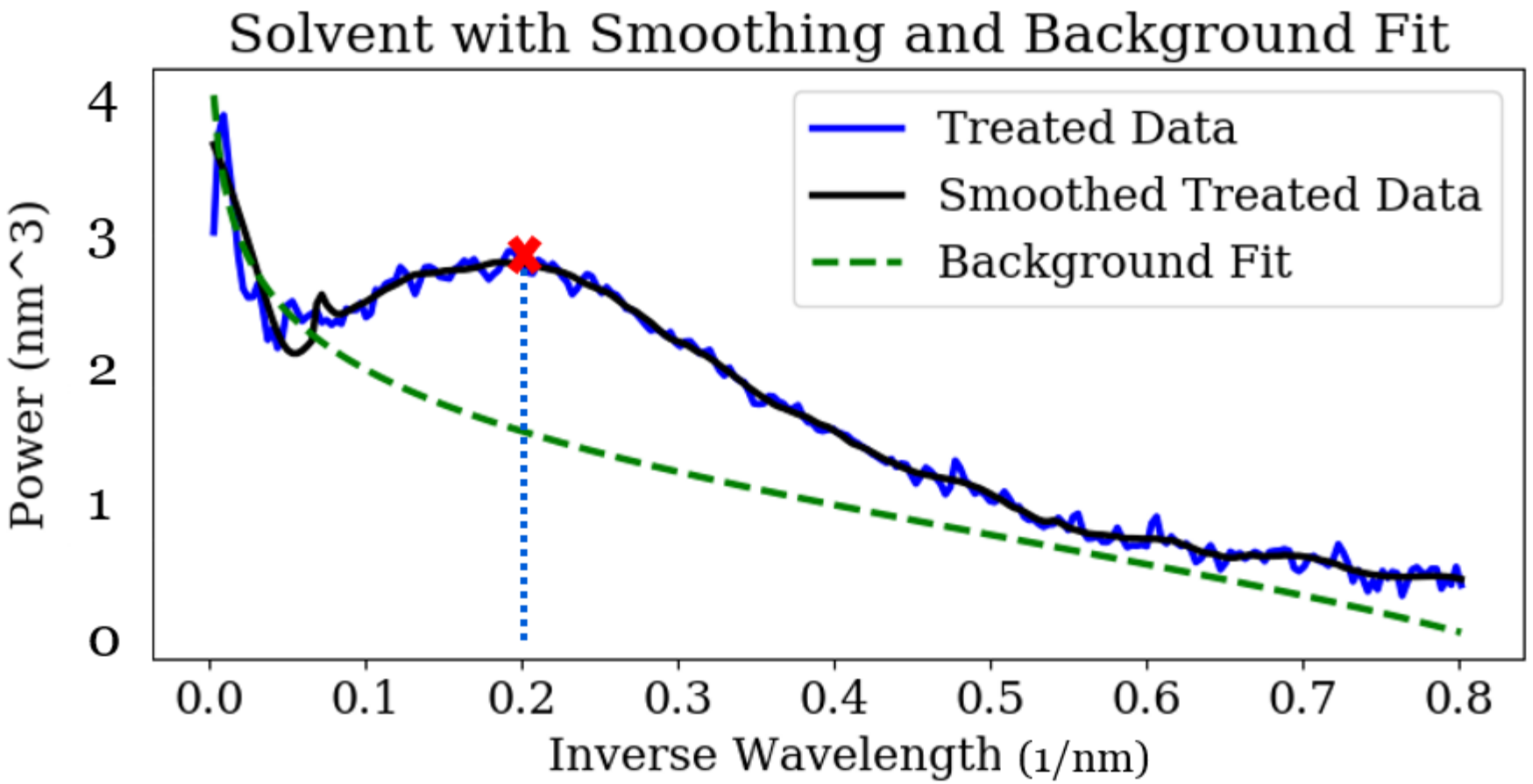
Results



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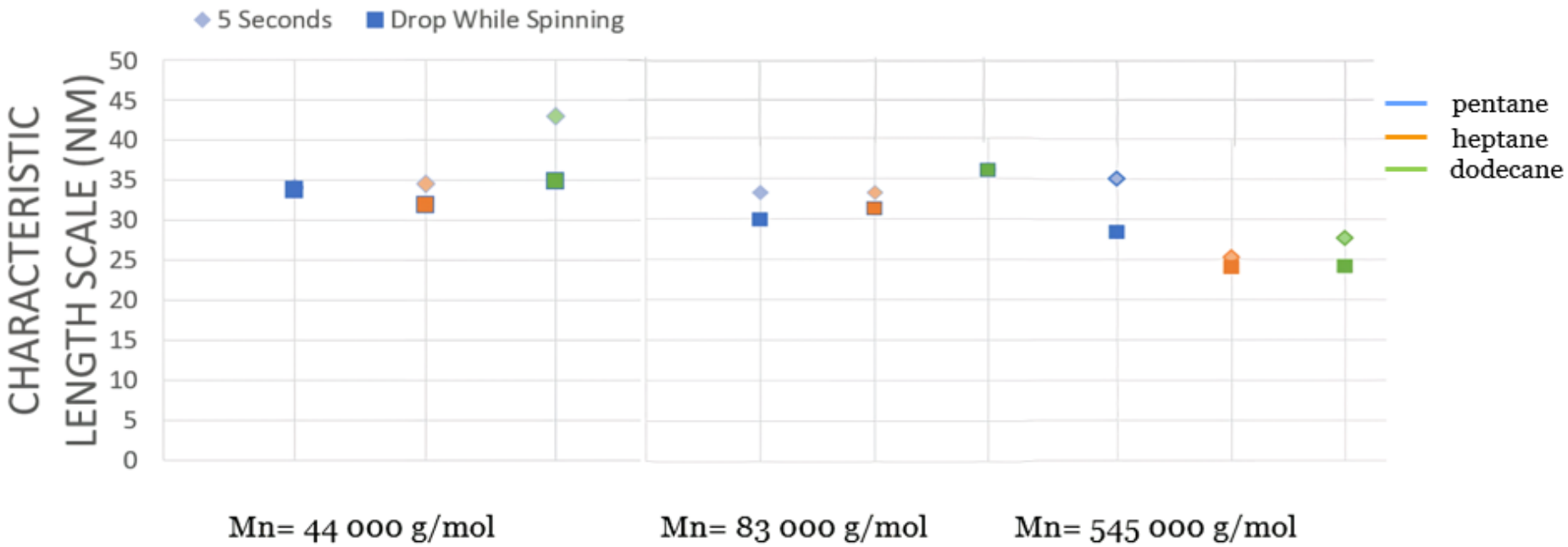
Results

→ *Characteristic length scales ranging from 25-45 nm*



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Conclusions

Poor solvents produce a nanoscopic surface morphology with a characteristic length scale

$\rightarrow$ *Independent of solvent type or exposure time*

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→ *Independent of solvent type or exposure time*

Future Work Required

→ *Produce results with an expanded list of molecular weights*

→ *Investigate if this type of solvent induced morphology occurs on other glassy polymers*

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Acknowledgements

James Forrest, Adam Reagen

Thank you!