

# A Fluorescent Technique for Sensing Melt Transitions of Semi-Crystalline Polymer Thin Films

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## Introduction

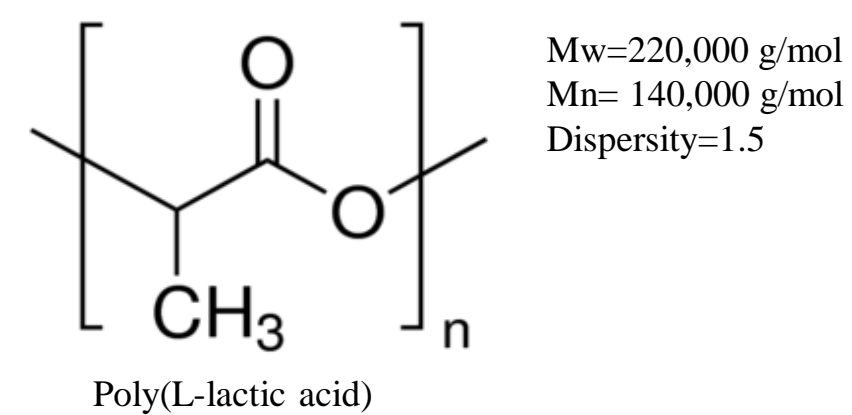
This research focuses on understanding the melting temperature and crystallization behavior at the interface of multi-layer semi-crystalline polymeric thin films using a location-specific fluorescence technique. The change in emission light intensity of a fluorescent dye doped or labeled semicrystalline poly(L-lactic acid) (PLLA) film is monitored with increasing temperature.

## Objective

- Develop a fluorescence technique for measuring the melting temperature of polymer thin films

## Method/ Materials

- Unlabeled PLLA



Mw=220,000 g/mol  
Mn= 140,000 g/mol  
Dispersity=1.5

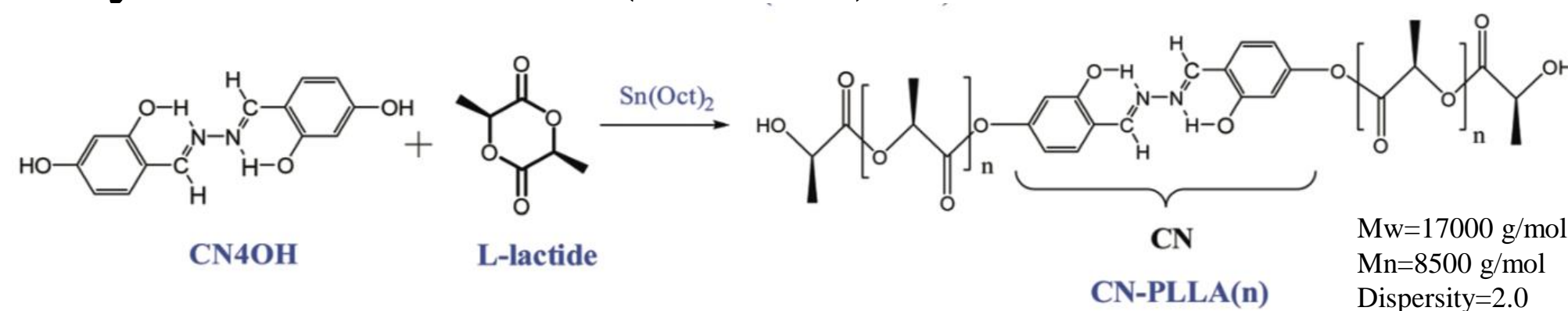


Commercial sample

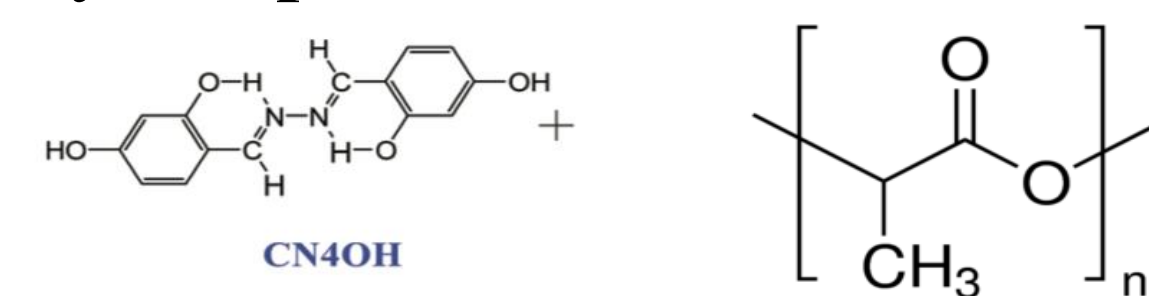


Pure sample (washed with toluene, precipitated in methanol)

- Dye-labeled PLLA (1 wt. %)

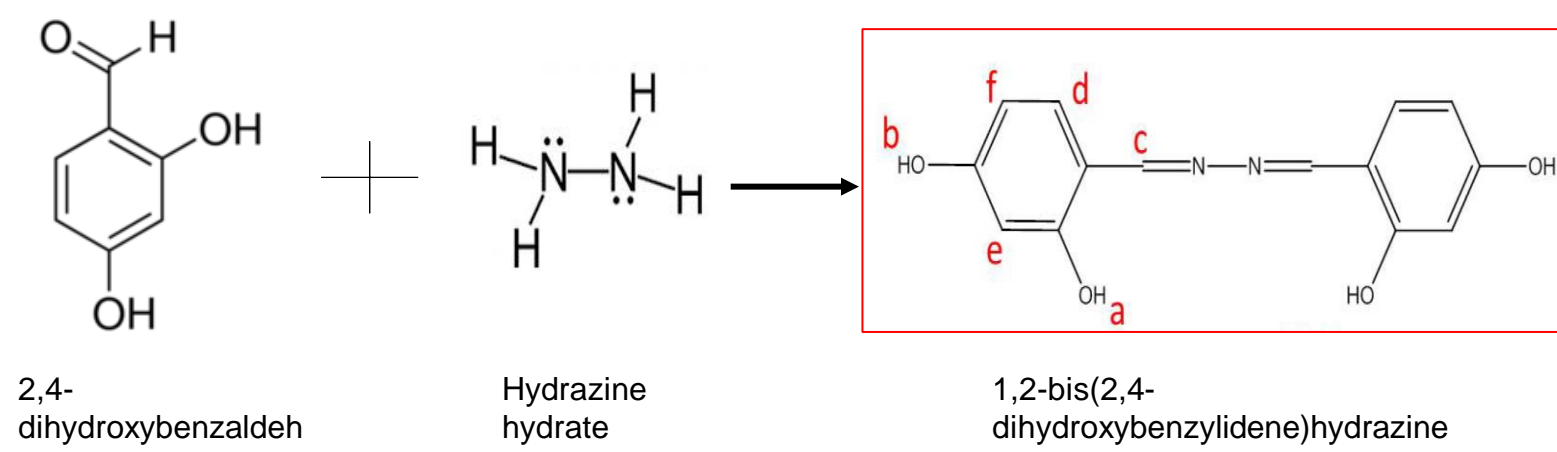


- Dye-doped PLLA (1 wt. %)



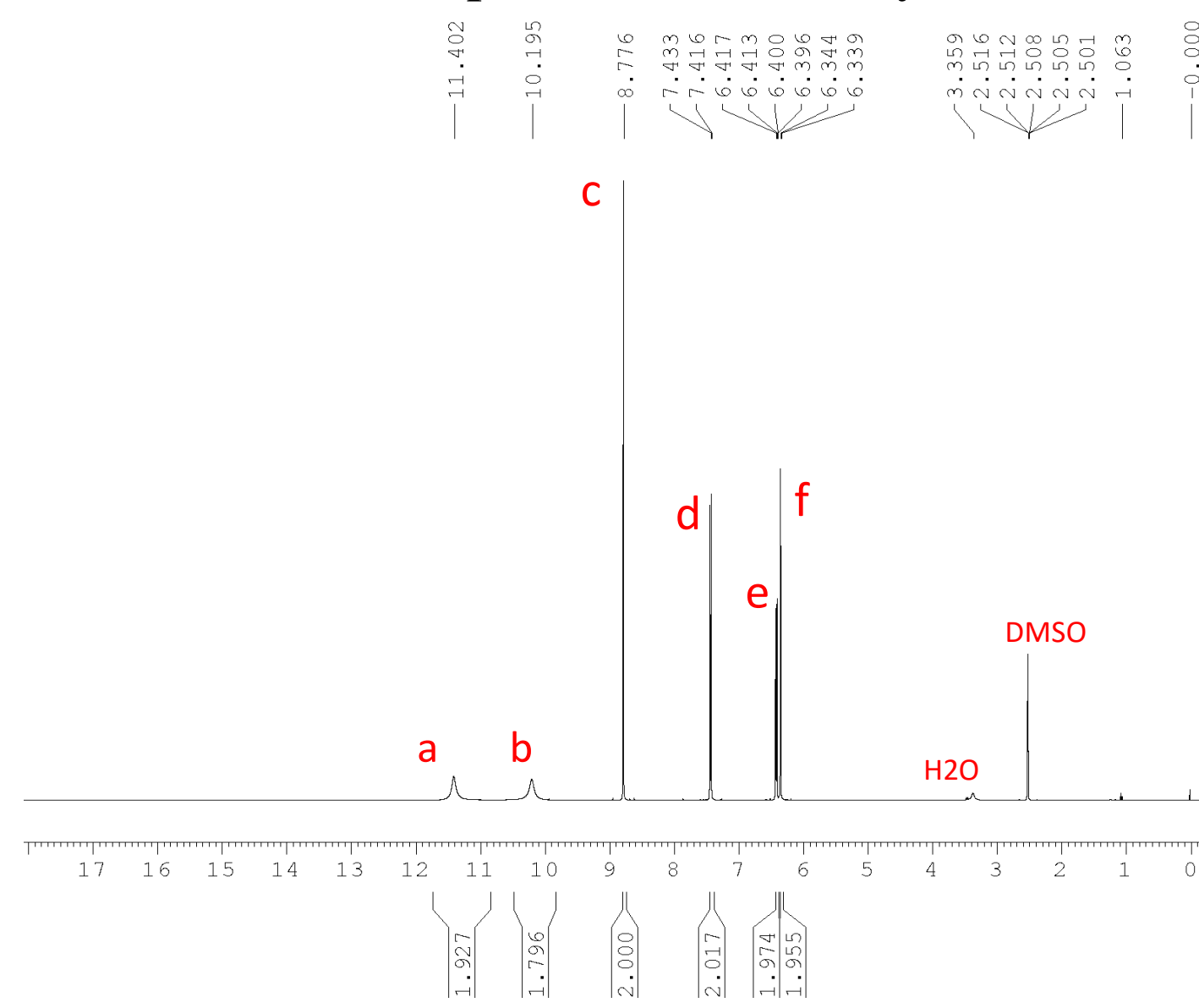
## Method/Materials

- Synthesize fluorescent CN4OH dye

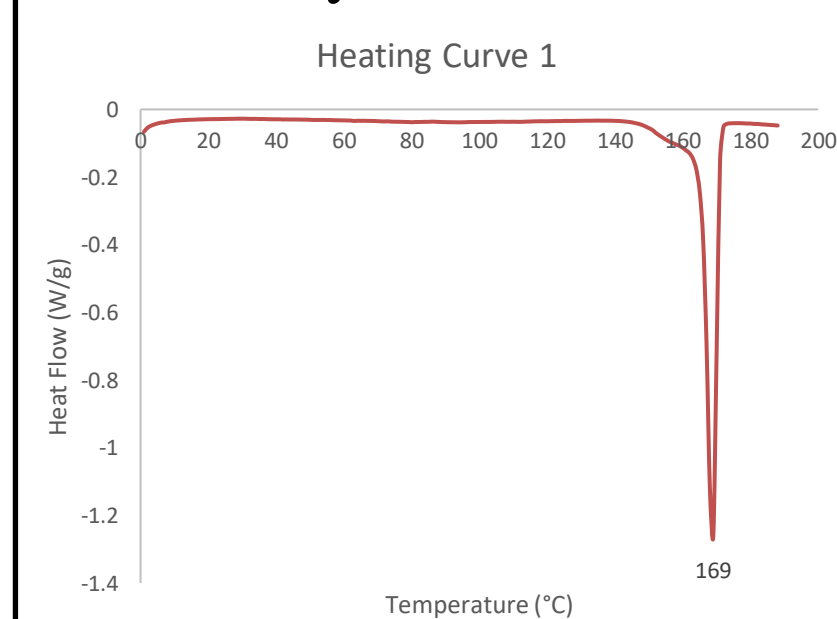


## Results

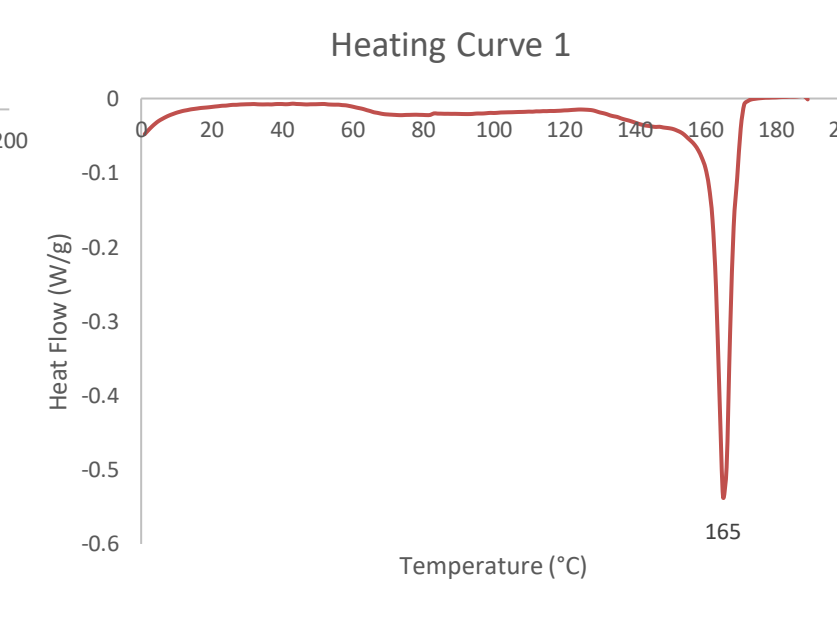
### NMR Spectra- CN4OH Dye



### DSC- Dye-Labeled PLLA

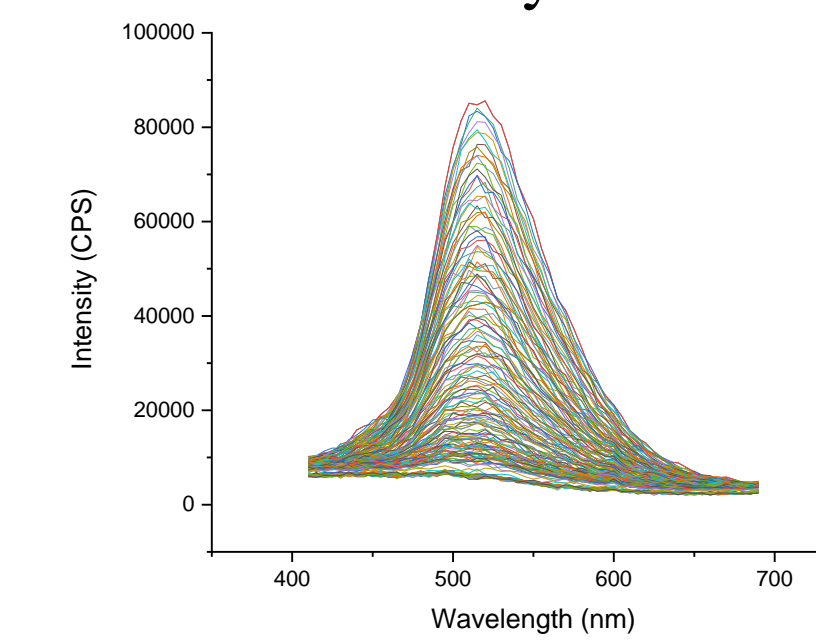


### DSC- Dye-Doped PLLA

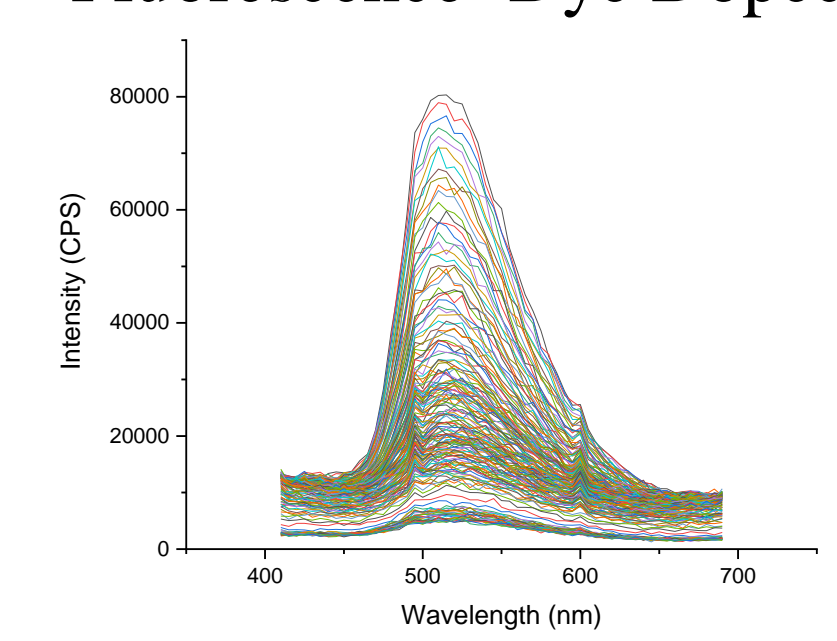


## Results

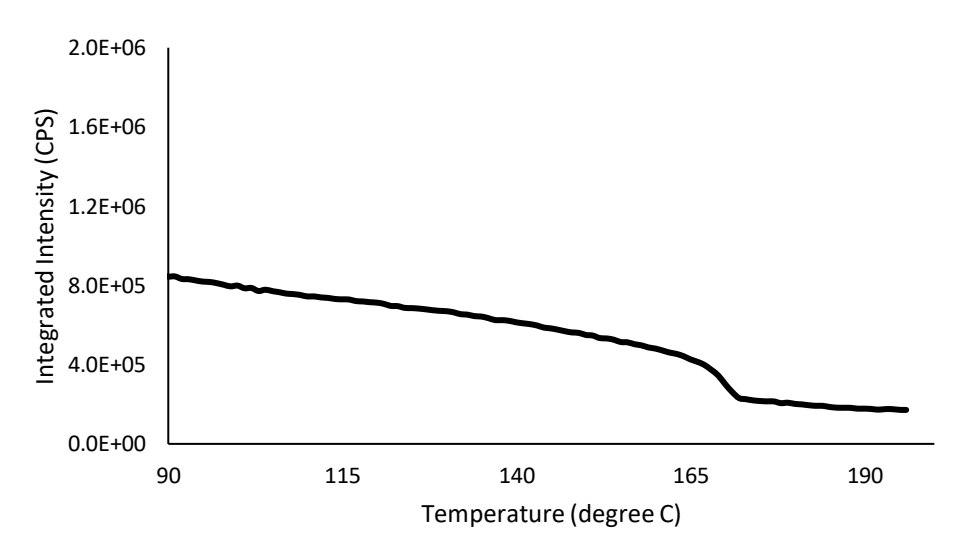
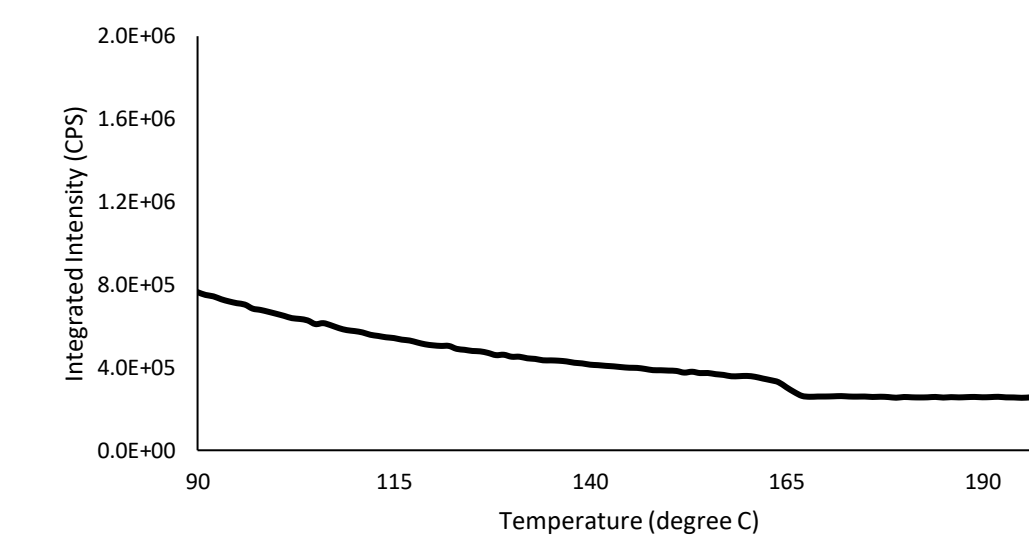
### Fluorescence- Dye Labeled PLLA



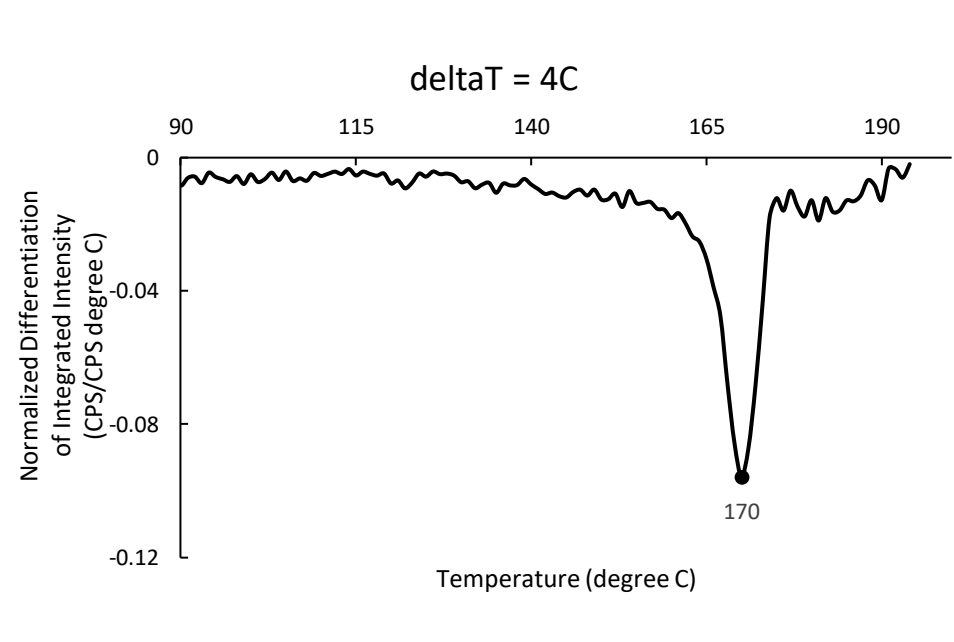
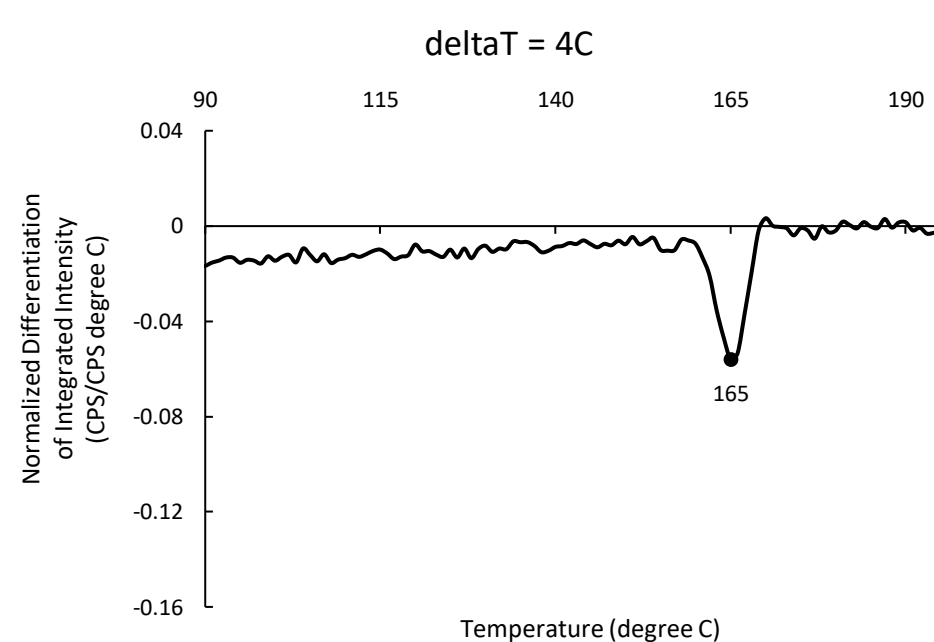
### Fluorescence- Dye Doped PLLA



Integration



Derivative



## Conclusions

A melting transition region centered at  $\sim 170$  °C was characterized via this fluorescence technique for semicrystalline poly(L-lactic acid), consistent with that obtained by conventional differential scanning calorimetry.

## Future Work

Compare fluorescence approach with existing thermal analysis and crystallographic techniques for the polymer

## Acknowledgments

- FURI
- ASU