# Investigation of Endothermic Events upon Heating on Cellulose Acetate Butyrate (CAB)

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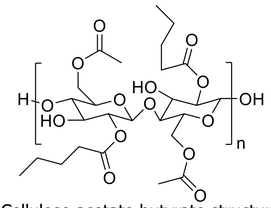
## Motivation and Goals

Upon heating using differential scanning calorimetry (DSC), Cellulose Acetate Butyrate (CAB) has endothermic peaks, that are often assigned to melting. However, inconsistencies about this phenomenon are reported in the literature: 1- the endothermic peaks are only observed in solution cast samples; 2- even though no crystallization is observed upon cooling, the crystallinity is observed to increase and 3- no melting is observed in the 2nd heating.

Understanding the thermal transition of polymers is important for their processing and application. Thus, **the goal of this project is to understand the origin of CAB endothermic peaks and how it impacts CAB properties.**

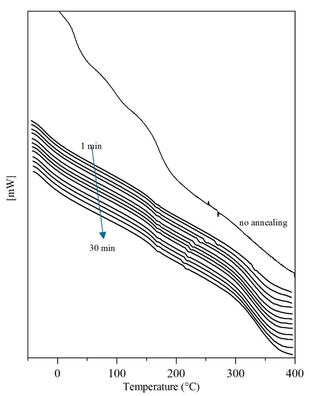


Cellulose acetate butyrate structure

## Sample Preparation

Solution cast samples were obtained from chloroform and dried in the vacuum oven. Melted samples were obtained in the melt press at 260°C

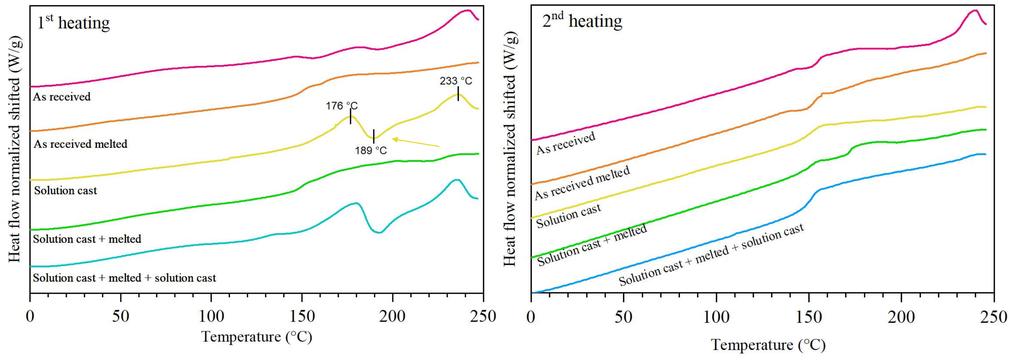
## Results



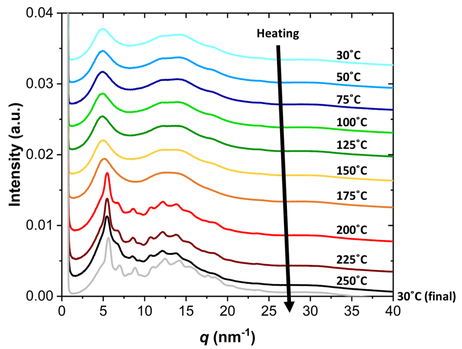

**Flash DSC** isothermal crystallization showed **endothermic peaks at high temperatures (>320 °C)**; probably related to the crystals formed upon heating.

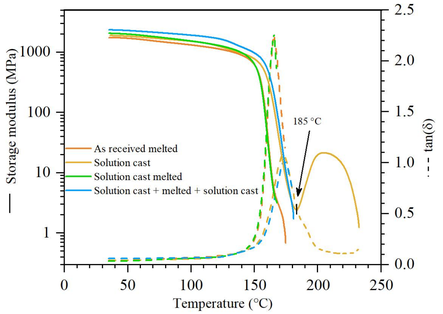
## Results

Only as received and solution cast samples have endothermic peaks in the 1st heating of DSC. On the 2nd heating, only the glass transition is observed.




Wide angle X-Ray scattering (**WAXS**) shows the **development of crystallinity** upon heating between 175 and 200 °C; which is the same temperature range an exothermic peak is observed in the 1st heating on DSC (yellow arrow).





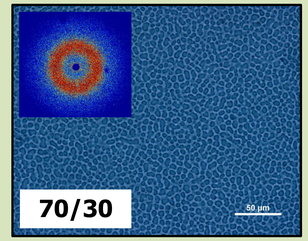

An **increase in the storage modulus** above the tan(δ) peak in Dynamic Mechanical Analysis (**DMA**) analysis also indicates structure formation

## Other Projects

Improving polysaccharides properties by blending and compatibilizing them.

- Evaluation of thermal, mechanical, and morphological properties

- ❑ Starch Acetate / Poly(L-Lactic Acid) Blends
- ❑ CAB / Gelatin Blends
- ❑ CAB / Polyethylene Terephthalate Blends




**Phase Contrast Optical Microscopy** and **Small Angle Laser Light Scattering** images of Starch Acetate/PLLA blends without compatibilizers

## Conclusion

- ❑ **WAXS, DSC, and DMA analysis indicates crystallization of CAB at ~ 190 °C**
- ❑ Probably the thermal treatment in melted samples caused crystallization, explaining the lack of endothermic peaks in the 1st heating
- ❑ The origin of the endothermic peaks is still unknown, future results from NMR, FTIR, fast DSC, and WAXS will help to understand it better.

## Acknowledgement

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