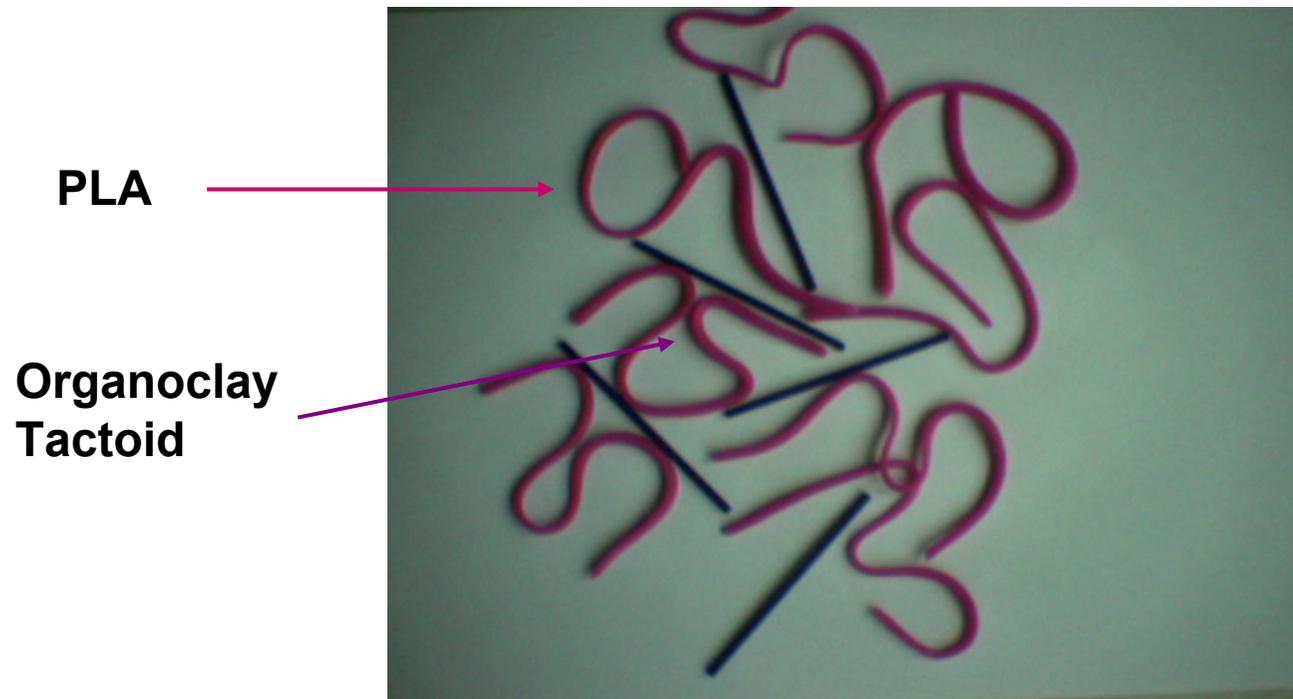


Effect of Processing Conditions on Biopolymer-Layered Silicate Nanocomposite Micromorphology

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Intercalation/Exfoliation



Distance of intercalation

Objectives

- Aim
 - To establish the best processing conditions and mixing method
- Objectives
 - To evaluate the effect of temperature, rotor speed and mixing time on the intercalation and exfoliation of C30B
 - To evaluate different mixing methods.
 - To characterise the samples by XRD and TEM

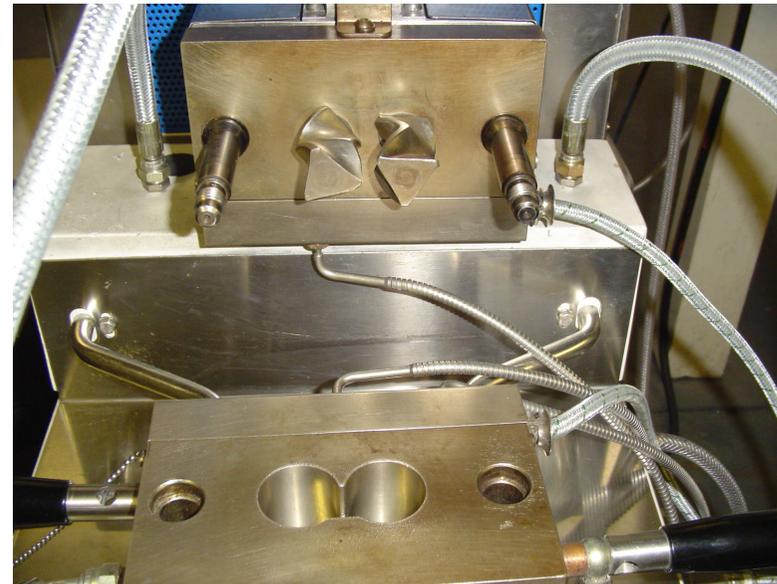
Materials

- HM1010 PLA (MWt 90-100KD)
provided by Hycail, BV (now Tate & Lyle)

- Cloisite 30B
provided by Southern Clay Products, Texas, USA

Melt compounding

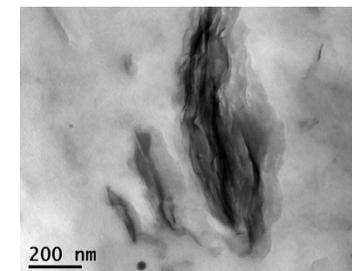
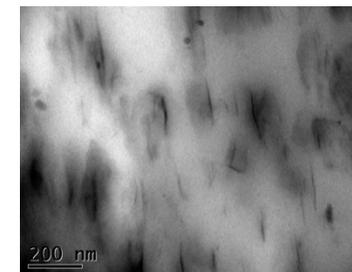
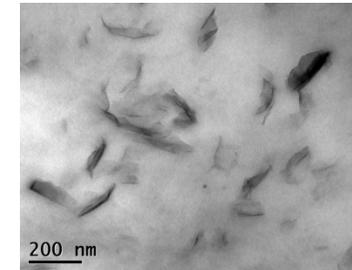
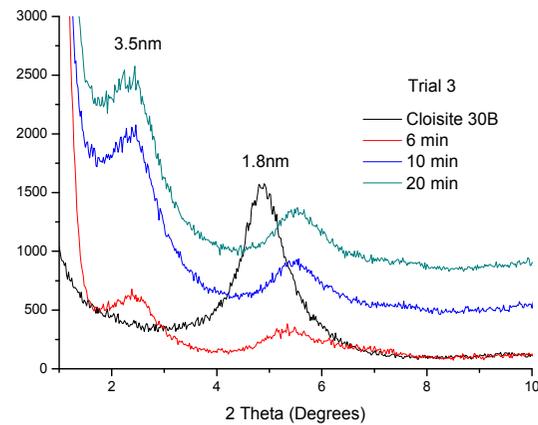
- PLA + 3% C30B
 - (both dried 50°C, 16h *in vacuo*)
- Polylab Torque Rheometer
 - Roller rotors
 - Fill factor = 0.7 x chamber volume



Processing Conditions

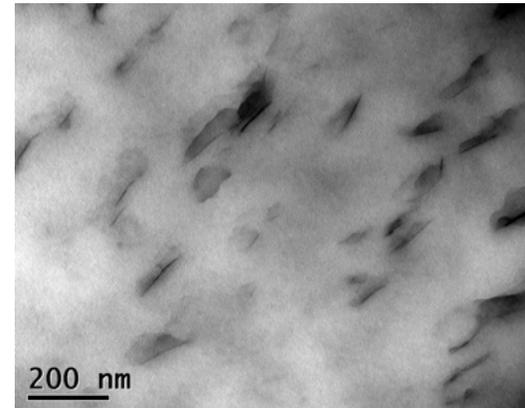
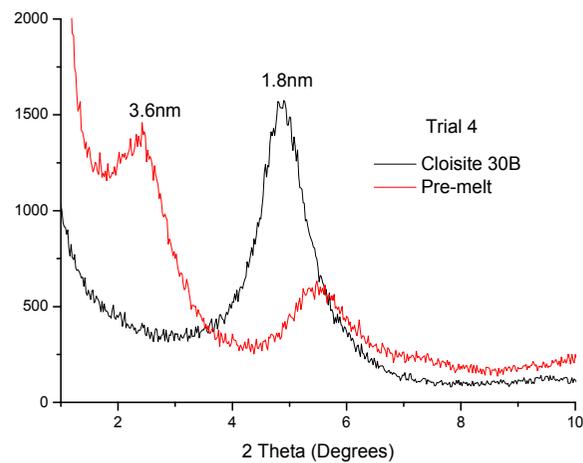
Trial	Temperature °C	Time min	Rotor Speed rpm	Filler Addition Method
1	190	10	60 / 85 / 110	1-step
2	170	10	100 / 120 / 140	1-step
3	170	6 / 10 / 20	100	1-step
4	170	10	100	Pre-melt
5	170	10	100	Masterbatch

Effect of Mixing Time



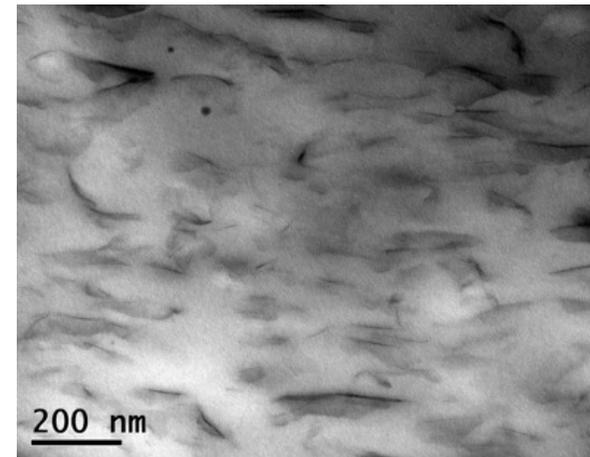
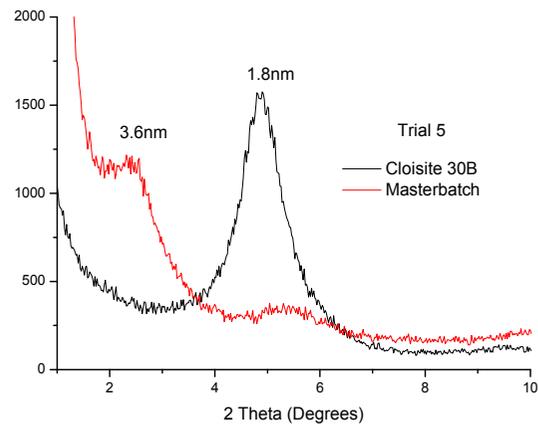
- Effect of Mixing Time:
 - Intercalation after 6 minutes
 - Exfoliation after 10 minutes
 - Some improvement after 20 minutes

Effect of Premixing



- Good Exfoliation
- Stopped organoclay from adhering to the rotors

Masterbatch Method



- Large population of exfoliated clay platelets
- Some intercalated clay remained but the intensity of the XRD signal was lower

Conclusions

- Varying the processing temperature and rotor speed had negligible effect on the degree of intercalation.
- In batch mixing, the method by which the polymer and clay are introduced greatly influences the degree of exfoliation and dispersion.
- The masterbatch method remains the most effective way of achieving a good degree of exfoliation by batch mixing.
- Thank you