Effect of Clay on Crystallization of Polyamide 6

A little Information...

Polyamide 6 has two phases: \(\alpha\) phase and \(\gamma\) phase.

Adding fillers should not change any phase. However, adding clay nanoparticles to polyamide 6 changes its phase from stable \(\alpha\) phase to meta-stable \(\gamma\) phase.

We would like to know why this happens.

Hypothesis

We believe that exchangeable and structural cations present on clay particles are responsible for the phase change. We will prove this by introducing defects in clay, so the interaction will increase.

Steps to prove

1. Specimen Preparation
   a) Using ball-milling to create defects in clay
   b) Extrude the clay with polyamide 6 (for pellet) and melt processing (for plates)

2. Qualification of the phases
   a) Use DSC to measure \(\alpha\) phase and \(\gamma\) phase in each specimen
   b) The specimen is in the form of pellet

Experiment Result

1. Ball-milled specimen have more \(\gamma\) phase compare to non-ball-milled specimen.
2. Compression molded sheet does not have any \(\gamma\) phase.
3. Magnesium ions containing clay has more \(\gamma\) phase compare to Sodium ions dominating clay.

Conclusion

From the result, we can conclude that the interaction is affecting transformation of \(\gamma\) phase.

Future Plan

1. Using Zeta Potential on assessing charges on milled clays, since there is possibility that dispersion is affecting interaction.
2. Use different temperature ramps in a DSC Test.