FT-IR spectroscopic study of hydrogen bonding in PA6/clay nanocomposites

Abstract. One of the most promising composite aterials would be hybrids based on organic polymers and inorganic clay minerals consisting of layered structures. Polymer/clay nanocomposites (PCN) exhibit improved tensile strength and moduli, decreased thermal expansion coefficient, decrease gas permeability, etc.

Materials and preparation. PA6CN as matrix and a co-intercalation organophilic montmorillonite clay prepared by melt compounding. A twin-screw extruder was used to the preparation of the nanocomposites.

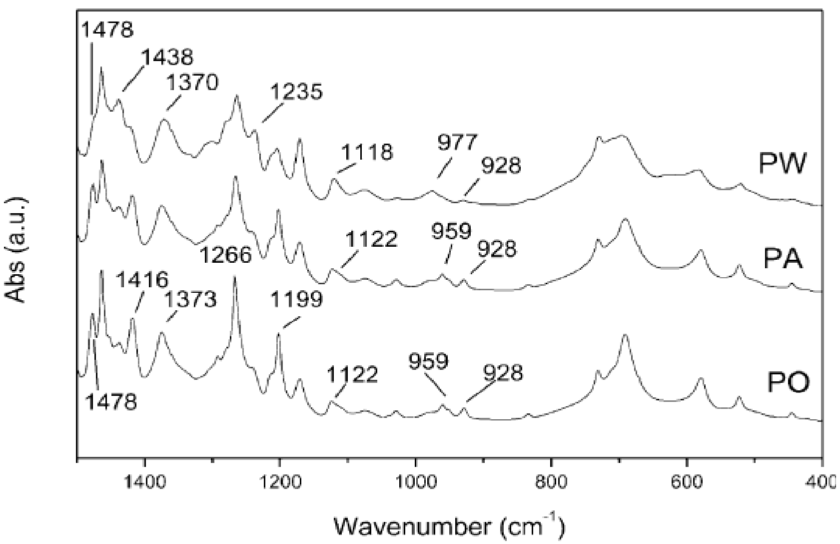

Fig. 1. FT-IR spectra of PA6 under various cooling conditions; PW: removed from the 250 °C oil bath and quenched in a water bath at 20 °C; PA: removed from the 250 °C oil bath and cooled in 20 °C air; PO: cooled down in oil bath from 250 to 20 °C by natural convection; the curves were stacked vertically for clarity.

Characterization → FTIR analyses using Perkin Elmer 2000 spectrometer.

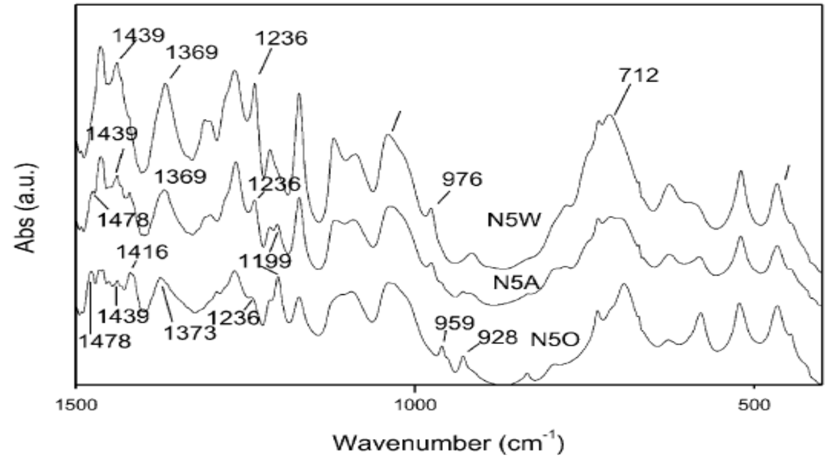

Fig. 2. FT-IR spectra of PA6/clay nanocomposite under various cooling conditions; N5W: removed from the 250 °C oil bath and quenched in a water bath at 20 °C; N5A: removed from the 250 °C oil bath and cooled in 20 °C air; N5O: cooled down in oil bath from 250 to 20 °C by natural convection; the curves were stacked vertically for clarity.

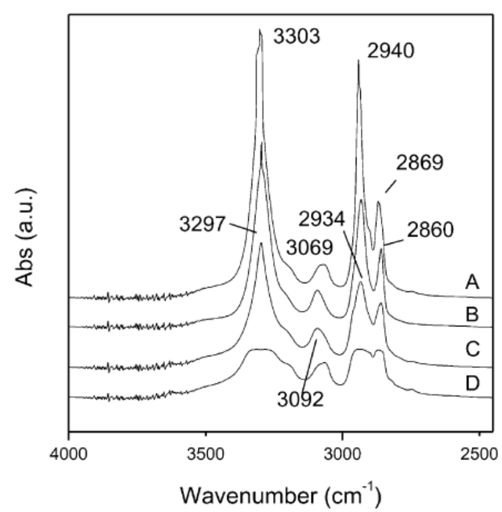

Fig. 3. FT-IR spectra of (A) α-phase PA6 with ~33% crystallinity; (B) γ-phase PA6 with ~31% crystallinity; (C) γ-phase PA6CN with ~49% crystallinity; (D) PA6CN with coexisting α- and γ-phases with ~39% crystallinity; the curves were stacked vertically for clarity.

Understand the interaction between silicate layers and PA6 at the molecular level! → focused on hydrogen bonding and different crystalline phases in PA6.

Conclusion: Silicate layers weaken the hydrogen bonding and favorates the formation of γ-phase.