TEMPERATURE EXPERIMENTS FOR IMPROVING ACCURACY IN THE CALCULATION OF THE DEGREE OF CRYSTALLINITY OF POLYAMIDE-11

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The calculation of the degree of crystallinity of polymeric materials may be rendered difficult by the number of overlapping crystalline phases, amorphous halos, and smectic phases that contribute to the diffraction pattern. Rilsan® Polyamide-11, or polyundecanamide, produced by ATOFINA Chemicals, Inc., is a semi-crystalline eleven-carbon molecule belonging to the same family as Nylon® 6 or Nylon® 6,6. Rilsan® PA-11 presents the particularity of having a smectic phase along with four crystalline phases (1, 2). Hydrogen bonding between polymer chains leads to the formation of a smectic phase in the polymer, and this smectic phase gives a contribution to the signal in the same 2θ region where we expect to observe the amorphous halo and some of the crystalline peaks. Additives in the polymer also give contributions in a narrow range of 2θ, which further complicates peak deconvolution work and the separation of amorphous and crystalline pattern contributions.

This paper will present how temperature experiments can help to better define the amorphous peak position at room temperature, how highly crystalline materials were used to further define a reliable peak deconvolution procedure following already published procedures (3, 4), how sample preparation can impact the measured crystallinity, and how degree of crystallinity calculated by DSC and XRD compare.

(4) Murthy N.S., Minor H. Polymer, 31(6), 996-1002, 1990.