Numerous studies have used SAXS to follow the course of melting of semicrystalline polymers; the phase transformation occurs over a range of 10 °C or more. SAXS patterns generally consist of a single interference maximum that shifts to lower angles during the heating/melting process. At the same time there is an increase in intensity at the lowest angles. Integrated intensity (invariant Q) decreases abruptly toward zero during the final stages of melting. Analyses of the scattering pattern are based on the correlation function \( r \) or the interface distribution function \( g(r) \) for stacks of lamellar crystals separated by amorphous regions. During the melting process the average period \( L \) increases by 50%-100%, as does the apparent dimension of one of the two phase thicknesses; the thickness of the other phase remains relatively constant. In some polymers there is evidence of scattering from isolated lamellae at the very end of the melting process.

Interpretation of these observations is hindered by uncertainties regarding the significance of SAXS parameters, particularly the phase thicknesses \( d_a \) (amorphous) and \( d_c \) (crystalline) and the related one dimensional crystallinity \( t = d_c/L \). In this work we simulate melting with a model in which a fraction \( p \) of the crystals in a stack are transformed to the amorphous state; melting is complete when \( p = 1 \). Those crystals that melt have no spatial correlation within the stack and may or may not have similar sizes. The surprising result is that SAXS from this model shows virtually no shift in the position of the peak, even though the average period of the stack increases as \( 1/(1-p) \). Melting is reflected in this model by an increase in continuous scattering that increases \( I(0) \) and a simultaneous decrease in the intensity of the interference maximum.