

**m37.o02****Polymer Melting versus Crystallization: a combined small-angle X-ray scattering and Atomic Force microscopy study**Dimitri A. Ivanov,<sup>a</sup> Marcel Dosière,<sup>b</sup> Michel H.J. Koch<sup>c</sup>

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The thermal behavior of semirigid-chain semicrystalline polymers is often very complex, exhibiting multiple endothermic and exothermic events related to melting and recrystallization. The origin of the differences between the flexible and semirigid-chain polymers is believed to lie in the higher energy expenditure associated with the formation of adjacent re-entry folds at the crystalline surface in the case of semirigid chains. The effect of constraints imposed by the interlamellar amorphous regions on the neighboring crystals was studied with temperature-resolved synchrotron radiation small-angle X-ray scattering (SAXS) and variable temperature Atomic Force Microscopy [1]. The analysis of SAXS patterns with a generalized paracrystalline lamellar stack model indicates that melting of a semirigid-chain polymer is not a random process but that the crystals grown in the smallest amorphous gaps melt first [2]. This suggests that the hitherto largely neglected geometrical confinement effects may play an important role in determining the thermodynamic stability of semirigid-chain polymer crystals.

[1] D.A. Ivanov; Z. Amalou; S.N. Magonov, *Macromolecules*, 34 (2001) 8944.

[2] D.A. Ivanov, S. Hocquet, M. Dosière, M. H.J. Koch, *Eur. Phys. J. E*, 13 (2004) 363.

**m37.o03****New SANS Instruments at the Oak Ridge High Flux Isotope Reactor and Spallation Neutron Source**G.D. Wignall<sup>a</sup>, W.T. Heller<sup>b</sup>, G.W. Lynn<sup>b</sup>, Y.B. Melnichenko<sup>a</sup>, D.A. Myles<sup>b</sup>, V.S. Urban<sup>b</sup>, J.K. Zhao<sup>c</sup>

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A series of upgrades have been undertaken at the High Flux Isotope Reactor (HFIR), based on the installation of a supercritical hydrogen moderator ( $T \sim 20^\circ\text{K}$ ), which feeds new instrumentation, including a 35m small angle neutron scattering (SANS) facility. This instrument is optimized for the study of biological systems as part of the Center for Structural Molecular Biology, funded by the Office of Biological and Environmental Research. In addition, there is a suite of instruments funded by the Office of Basic Energy Sciences, including a high-resolution 40m SANS camera. Both facilities have variable wavelength ( $5 < \lambda < 25 \text{ \AA}$ ), with large area ( $1\text{m}^2$ ), high count-rate detectors ( $> 10^5 \text{ Hz}$ ), that can translate up to 45cm off-axis to increase the dynamic Q-range ( $< 0.001\text{-}1 \text{ \AA}^{-1}$  overall). As the HFIR is one of only two reactors with a core flux  $> 10^{15}$  neutrons/sec/cm<sup>2</sup>, the beam intensities (up to  $10^7$ /sec/cm<sup>2</sup>) are comparable to the best facilities worldwide. In addition, an extended Q-range small-angle scattering diffractometer at the Spallation Neutron Source is designed to cover an unprecedented range in Q-space ( $0.004 < Q < 12 \text{ \AA}^{-1}$ ) with a very high integrated sample flux ( $10^8\text{-}10^9$ /sec/cm<sup>2</sup>). This instrument is optimized for studying complex systems that require data collection at low and high-Q simultaneously. The combination of the new steady-state and pulsed SANS instrumentation will expedite data collection from biological macromolecules, the study smaller sample quantities and facilitate kinetic (time-resolved) experiments.