Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Diffusion of Particles in the Melt of Polymeric Rings and Diffusion of Proteins in the Cell Nucleus[1] KURT KREMER, Max Planck Institue for Polymer Research, Mainz, Germany, JONATHAN HALVERSON, Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, NY, GARY GREST, Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque, NM, ALEXANDER GROSBERG, Department of Physics, New York University, New York, NY — Ring polymers in the melt are partially collapsed and partially segregated as revealed by both simulation and experiment. This behavior is qualitatively consistent with the arrangement of chromosomes in the cell nucleus which are found in distinct territories. Working under the hypothesis that a melt of nonconcatenated rings serves as a simple model for the packing of chromatin fibers in the nucleus of higher eukaryotes, we have investigated the dynamic behavior of a non-sticky spherical particle in polymer melts composed of rings using molecular dynamics simulation. Linear chains are also studied for comparison. In the case of rings such systems are thought to represent protein diffusion in the cell nucleus. The subdiffusive motion of the particle is found to be independent of the polymer architecture and chain length but depends strongly on particle size. The long-time behavior suggests that these particles diffuse faster in the rings. We compare our results to existing models of protein diffusion.

[1]Research carried out in part at the Center for Functional Nanomaterials, Brookhaven National Laboratory, which is supported by the U.S. Department of Energy, Office of Basic Energy Sciences, under Contract No. DE-AC02-98CH10886.

Jonathan Halverson
Center for Functional Nanomaterials,
Brookhaven National Laboratory, Upton, NY

Date submitted: 14 Nov 2011 Electronic form version 1.4