MAR06-2005-000101

Abstract for an Invited Paper
for the MAR06 Meeting of
the American Physical Society

Thermodynamics and Structure of Polymerizing Actin

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The polymerization of the globular protein G-actin to form filamentary F-actin is an important cellular process, serving major functions in cell structure and cell motility. This transition from monomeric G-actin to polymeric F-actin can be initiated by the variation of thermodynamic variables such as temperature, pressure, and compositions of G-actin and salts. We use fluorescence spectroscopy to obtain the fraction of monomer converted to polymer, and model these data using a Flory-Huggins type of theory. We measure the size and shape of the actin species by small angle neutron scattering, and find an unexpected spherical shape for G-actin in salt buffer.