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## Isotropic to Nematic Phase Transition in F-actin

N. CHAKRABARTI\* and P. DAS\*\*

Department of Chemistry, Bose Institute, 93/1 A. P. C. Road, Calcutta 700 009, India

**Abstract** - Like a few other rod-like and semi-rigid polyelectrolytes, filamentous actin (F-actin) shows, respectively, an isotropic to nematic (I-N) phase transition and an aggregation to a hexagonal liquid crystal followed by paracrystals at low and moderately high salt concentrations. Its polyion characteristics, e.g., large bare diameter, imposing chain length, high molecular weight per unit chain contour length and large electronic charge spacing along the chain contour, make it stand out among the members of the family of rigid and semi-rigid lyotropic mesogens. The first-order I-N phase separation has been explored, at the level of the second virial approximation, for a rod-like model of the actin filament in a solution containing simple electrolytes such as KCl and MgCl<sub>2</sub>. The calculation of concentrations in the coexisting isotropic and anisotropic (nematic) phases, and of the order parameter in the anisotropic phase has been attempted by following the approach of Stroobants et al. which takes account the repulsive but not the attractive interactions. A criterion for the stability of the isotropic phase, according to Odijk, considers the second and the third virial coefficients, and has been employed to describe the I-N phase diagram depicting filament length versus actin concentration. The nature of the I-N phase transition, which has both first-order and higher-order (continuous) parts, has been discussed.

**Keywords** : F-actin, isotropic phase, nematic phase, liquid crystal, paracrystals.

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\*Present Address : Department of Physics, Bangabasi College, 19 Rajkumar Chakraborty Sarani, Kolkata-700 009. Email : pdas@bosemain.boseinst.ac.in; Fax : 91-33-2350 6790

\*\* Author for correspondence.