Iranian Journal of Physics Research, Vol. 25, No. 1, 2025
DOI: 10.47176/ijpr.25.1.81962

First–order phase transition of rectangular disk-shaped particles confined between two walls: Isotropic to nematic and 2H-1P to 4H-1P

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(Received 25 August 2024; in final form 27 October 2024)

Abstract
In this paper, we investigate a system composed of disk-shaped particles with a square cross-section ($D\times D$) and thickness *L*, confined between two hard walls separated by a distance *H*. Employing Onsager theory and the Zwanzig approximation, we demonstrate that the isotropic-nematic phase transition of these particles weakens and eventually disappears as the wall separation decreases. Our findings exhibit qualitative agreement with previous studies. Furthermore, we show that particles with approximate aspect ratio *L/D*=0.2 undergo a first-order phase transition from a 2H-1P phase to a 4H-1P phase for specific wall separations. This phase transition terminates at two critical points and occurs at lower densities as the wall separation increases within the coexistence region. The characteristic phase transition vanishes as the aspect ratio deviates from *L/D*=0.2 .

Keywords: phase transition, Onsager, isotropic, nematic, lyotropic

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