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Enhanced Elasticity and Soft Glassy Rheology of a Smectic Liquid Crystal in a Random Porous Environment DENNIS LIANG, RANJINI BANDYOPADHYAY, Johns Hopkins U., RALPH COLBY, Pennsylvania State U., JAMES HARDEN, University of Ottawa, ROBERT LEHENY, Johns Hopkins U. — We present rheometry studies of the frequency dependent shear modulus, $G^*(\omega) = G'(\omega) + iG''(\omega)$, of the smectic liquid crystal octylcyanobiphenyl (8CB) confined by a colloidal silica gel. When the 8CB is in the isotropic or nematic phase, the shear modulus is independent of temperature and dominated by the elasticity of the gel. With the onset of smectic order, G' grows approximately linearly with decreasing temperature and reaches values that can exceed by more than 3 orders of magnitude the values for pure 8CB. The modulus in the smectic phase possesses a weak power-law dependence on frequency, $G^*(\omega) \sim \omega^\alpha$, with the exponent α approaching zero with increasing gel density. Within the soft glassy rheology model, such a decreasing exponent indicates an approach to a glass transition, which we correlate with the increasing random field coupling between the gel and smectic. We further interpret the enhanced elasticity and weak power law dependence of $G^*(\omega)$ as the result of a dense population of defects in the disordered smectic.

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