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Freeze Fracture and AFM Studies of the Liquid Crystal Dark Conglomerate and B4 Phases L.E. HOUGH, M. SPANNUTH, Department of Physics, University of Colorado Boulder, H.J. JUNG, J. ZASADZINSKI, Department of Chemical Engineering, University of California, Santa Barbara, D. KRUERKE, G. HEPPKE, Institute of Inorganic and Analytical Chemistry, Technical University of Berlin, DAVID WALBA, Department of Chemistry and Biochemistry, University of Colorado Boulder, NOEL CLARK, Department of Physics, University of Colorado Boulder — Using freeze fracture transmission electron microscopy (FFTEM) and AFM, we show that the Dark Conglomerate and B4 phases are layered structures dominated by saddle splay. The B4 layer structure consists of a TGB like phase made up of parallel arrays multiple burgers vector screw dislocations (grain boundaries) giving pi/2 rotations across the grain boundaries. Models of the layer structure based on periodic arrays of grain boundaries, each described by Scherk's first surface, yield key features of the observed structures. The dark conglomerate phase is an optically isotropic thermotropic analog of the lyotropic sponge phase and appears to be a disordered form of the saddle splay stabilized structure proposed for the smectic blue phase by DiDonna and Kamien [PRL 89, 215504]. We propose that the mechanism for saddle splay is intralayer frustration produced by mismatch in the in-layer plane area of different molecular subfragments. This work is supported by a NSF Graduate Research Fellowship and by NSF MRSEC Grant DMR0213918.

Noel Clark

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