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Temperature evolution of the linear birefringence in striated single crystals of $KTa_{1-x}Nb_xO_3$(KTN) DANIEL JACKSON, Dept. of Phys., Lehigh University, Bethlehem PA, 18015, USA, RADHA PATTNAIK, Phys. Dept., Lafayette College, Easton, PA 18042, USA, AHARON AGRANAT, Dept. of Appl. Phys., The Hebrew University of Jerusalem, Jerusalem 91904, Israel, JEAN TOULOUSE, Dept. of Phys., Lehigh University, Bethlehem PA, 18015, USA — We report the temperature evolution of a special linear birefringence in 3 crystals of $KTa_{1-x}Nb_xO_3$(KTN), with x=0.155, 0.27 and 0.36 respectively, upon approaching the cubic-tetragonal phase transition. This birefringence, which is in violation of crystalline symmetry conditions, is caused by growth striations in the crystal that give rise to local strain and result in an average uniaxial behavior due to the photoelastic effect. Simultaneously, the set of parallel striations acts as a volume phase grating which can produce diffracted beams. Upon approaching the phase transition, the measured birefringence displays a rapid temperature dependence which is due to the formation of polar nano-domains (PND). These are incipient tetragonal uniaxial domains preferentially oriented with their c-axis perpendicular to the plane of the striations. As the birefringence increases, the diffraction efficiency unexpectedly decreases, indicating that the phase grating amplitude is occluded by the PND formation. The striation pattern is well defined in the 15.5% crystal, more diffuse in the 36% crystal, and there are no obvious striations in the 27% crystal. Experimental results are presented and a simple phenomenological model for the birefringence behavior is proposed and discussed.

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