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A Monte Carlo Study of Frozen Lattices on Curved Surfaces A. HEXEMER, E. J. KRAMER, G. H. FREDRIKSON, UCSB, V. VITELLI, D. R. NELSON, Harvard — We compare the defect structure and density of particles confined on 2d surfaces with different curvatures as well as different surface morphologies. All simulations are performed using a smart Monte Carlo algorithm while the particle system is cooled from a melted state to zero degree temperature. The surfaces show similar defect patterns. At low maximum Gaussian curvature a hexagonal lattice wraps defect-free onto the curved surface. We then observe a critical maximum curvature at which the creation of defects lowers the potential energy of the lattice with respect to the defect-free lattice. At this critical value we observe free dislocations located at the inflection points of the surface. Further increase in curvature results in the creation of more free dislocations which organize in grain boundaries aligned along the shortest connection between the positive and negative Gaussian curvature areas. A stronger curvature leads to the creation of free disclinations. The -60^o disclinations are pinned to the area of positive curvature while the $+60^o$ disclinations occupy the negative areas. The transition from the defect free lattice to a defected lattice as the lowest energy state is compared to an analytic expression derived from continuum mechanics.

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