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Wrinkling Instability Induced by Imposed Gaussian Curvature in the Zero-tension Limit[1] YIWEI SUN, BENNY DAVIDOVITCH, GREGORY GRASON, Univ of Mass - Amherst — The adhesion of thin stiff films onto spherical substrates introduces compressive stresses, which cause the laminated film to buckle out of plane. Previous studies addressed the emerging wrinkle pattern in the limit of zero bending modulus and the presence of surface tension at the boundary, and found the radius of the inner unwrinkled zone scales with the tension. Here we study another fundamental limit: finite bending modulus and zero exerted tension. In this limit, subtlety will arise from the fact that the singular expansion, which previous studies relied on, becomes ill-defined. To reveal the morphology in the zero-tension limit, we employ numerical simulations based on bead-bond model. Surprisingly, we find that the scaling law for the radius of the unwrinkled zone can be generalized from the finite tension to the zero tension limit, by applying a bending modulus dependent term to the tension dominated scale. The simulation results also highlight the residual compressive hoop stress, which is scaled by bending modulus in the absence of tension. The findings suggest the existence of a new, yet unstudied process, by which the deformed shape of the sheet approaches isometry as the bending modulus vanishes, in the absence of boundary loads.

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