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Stretch-induced wrinkles in reinforced membranes ATSUSHI TAKEI, ESPCI, FABIAN BRAU, Universit de Mons , BENOÎT ROMAN, JOSÉ BICO, ESPCI — We study through model experiments the buckling of a rigid stripe (or fiber) embedded in a soft membrane under compression. The compression is induced through Poisson effect when the membrane is stretched perpendicularly to the stripe. The wavelength of the wrinkles is found to depend on the material properties and the stretching strain. A balance between the bending and stretching energies of both the membrane and the stripes dictates this wavelength: $\lambda \sim (Bd\ /E_S H_S \delta\ )^{1/3}$, where B is the bending stiffness, d the width of the rigid band, δ the strain, and E_S andH_S the Young modulus and the thickness of the membrane, respectively. The characteristic extension of the wrinkled zone is set by the wavelength. This result also applies to fibers imbedded in a thin membrane. However, in-plane buckling is observed when the thickness of the membrane is large compared with the radius of the fiber. In this last regime, we find $\lambda \sim R(E_F\ /E_S\ )^{1/4}$, where $E_F$and R are the Young modulus and the radius of the fiber, respectively.

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