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Ultra-soft 100 nm thick zero Poisson's ratio film with 60% reversible compressibility CHIEU NGUYEN, STEVE SZALEWSKI, RAVI SARAF, None — Squeezing films of most solids, liquids and granular materials causes dilation in the lateral dimension which is characterized by a positive Poisson's ratio. Auxetic materials, such as, special foams, crumpled graphite, zeolites, spectrin/actin membrane, and carbon nanotube laminates shrink, i.e., their Poisson's ratio is negative. As a result of Poisson's effect, the force to squeeze an amorphous material, such as a viscous thin film coating adhered to rigid surface increases by over million fold as the thickness decreases from 10 μm to 100 nm due to constrain on lateral deformations and off-plane relaxation. We demonstrate, ultra-soft, 100 nm films of polymer/nanoparticle composite adhered to 1.25 cm diameter glass that can be reversibly squeezed over 60% strain between rigid plates requiring (very) low stresses below 100 KPa. Unlike non-zero Poisson's ratio materials, stiffness decreases with thickness, and the stress distribution is uniform over the film as mapped electro-optically. The high deformability at very low stresses is explained by considering reentrant cellular structure found in cork and the wings of beetles that have Poisson's ratio near zero.

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