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Bubble Shapes in Foams: The Importance of Being Isotropic

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Foams, and by extension a whole class of random cellular materials are characterized by minimizing total interfacial area between the cells. Both structure and evolution of such materials by aging (coarsening) are ill-understood because of our lack of knowledge of the cell geometry. Combining Plateau's rules and certain symmetry requirements, we analytically determine the geometry of generic polyhedral cells we call Isotropic Plateau Polyhedra (IPPs). Their properties, such as surface area, edge length, or coarsening rate, are exactly known and very close approximations to the corresponding properties of average, random foam bubbles. Certain IPPs can also be found experimentally in soap foam. We show that measuring the coarsening rate of these bubbles allows for the simple computation of the soap film thickness, which is found to vary with foam age.

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