Boundary curvature effect on the wrinkling of thin suspended films

Scilight

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Boundary curvature of thin films impacts its wrinkling

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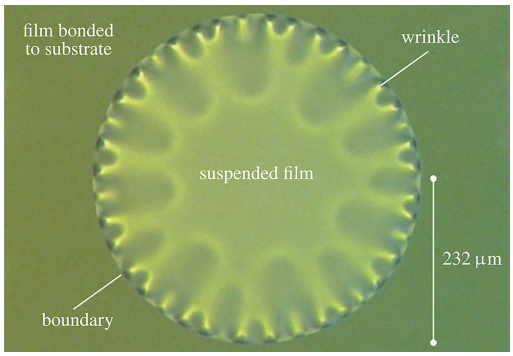
Wrinkling is an easy way to create self-similar surface patterns on materials, so it is important to understand the factors that play a role in its development.



Wrinkling is a ubiquitous phenomenon, occurring everywhere from nature's leaves to man-made thin films. Self-similar wrinkling patterns can sometimes aid in the design of efficient devices, such as solar cells, but may also have adverse operational effects in devices like pressure sensors. In order to better understand wrinkling behaviors, Janssens *et al*. studied the relationship between the wrinkling of a suspended circular film and its boundary curvature and they determined an alternative method for measuring its compressive strain.

The authors found the boundary curvature of the film has a strong influence on the wavelength of its wrinkles. The group counted the number of wrinkles in a suspended film, normalized to its circumference, to determine the wrinkle wavelength. Suspended nanocrystalline films supported by glass substrates, which are promising candidates for the development of 3D microdevices and nanodevices, were used.

“We, initially, did not expect that the film's radius would have a drastic effect on the wrinkle wavelength,” said author Stoffel Janssens.

To explain these observations, they generalized a previous technique for predicting wrinkle wavelengths and constructed a method to accurately estimate the film's strain.

Because wrinkling is an efficient strategy for obtaining self-similar surface patterns, author Eliot Fried noted this method is a promising alternative to standard strain characterization methods, especially for films that can be assembled to be two-dimensional.

“The model presented in our work provides a simple tool to design a new class of smart surfaces in which curvature is used to generate short wavelength patterns through wrinkling,” he said.

Source: “Boundary curvature effect on the wrinkling of thin suspended films,” by Stoffel D. Janssens, Burhannudin Sutisna, Alessandro Giussani, James A. Kwiecinski, David Vázquez-Cortés, and Eliot Fried, *Applied Physics Letters* (2020). The article can be accessed at https://doi.org/10.1063/5.0006164.