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The life of bubbles under negative pressure JIN WOO CHOI, KEUN-HWAN PARK, Seoul National University, SO NAGASHIMA, MYOUNG-WOON MOON, Korea Institute of Science and Technology, HO-YOUNG KIM, Seoul National University — Cavitation of sap in plant vessels, or embolism, may occur when the liquid pressure becomes negative either in a high elevation or a dry environment. Effective suppression of nucleation and growth of cavitation bubbles is important for continuous transport of water and thus survival of the plant. Here we investigate the life of cavitation bubbles under negative pressure from their nucleation through growth and maturation. As a model system for the plant vessel, we fabricate hydrogel microchannels whose inner pressure is reduced to a negative value. The roughness of the channel surface is modified by plasma treatment to form wrinkles emulating observed xylem wall surfaces. We find a finite effect of surface wrinkles on the critical nucleation pressure. Also, dense wrinkles tend to slow down bubble growth. In all the channel roughness conditions, the bubbles grow diffusively with time until their maturation. Then in the matured stage, the growth speed is substantially lowered and follows the value determined by Darcys law. Our results suggest that surface wrinkles or roughness can be used to control the nucleation pressure and bubble growth behavior. Also, the observations can give deeper insight into embolism control mechanisms of tall trees.

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