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Pit-level strategy of gymnosperms for regulation of two-phase flow[1] JOOYOUNG PARK, SUNG HO PARK, JEONGEUN RYU, SANG JOON LEE, Pohang Univ of Sci Tech, BIOMIMETIC BIOFLUID RESEARCH TEAM
— Gymnosperms living in arid and cold regions transport water against threat of cavitation. Torus-margo (TM) pit of gymnosperms, which is consist of a thickened torus held at the center by margo strands, has been reported as a key structure for the regulation of two-phase flow through adjacent tracheids. However, detailed hydrodynamics at a single bordered pit remains unclear. Herein, we demonstrate the air spreading through a channel system by using synthetic TM-pit system. The air spreading dynamics through the TM-pit system depends on the thickness of torus and margo parts. On the basis of the experimental results, we suggest a structural criterion of TM-pit systems to seal both of initial and consecutive air spread without sacrificing their hydraulic conductivity. The criterion compares with morphological data of TM-pits, implying that the valve-like behavior of TM-pit may alleviate the tradeoff between hydraulic safety and efficiency of gymnosperms at the pit-level. Our study will advance the understanding of pit-level strategy of gymnosperms as well as provide insights into various areas regulating interfacial phenomena in fluidic systems.

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