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A Surface-Tension-Driven Nanoliter Mixer With Optimized Grooved Structures for Microchannels CHIEN-CHENG CHANG, CHUH-YU KUO, Division of Mechanics, Research Center for Applied Science, Academia Sinica, CHEIN-FU CHEN, CHUN-FEI KUNG, CHIN-CHOU CHU, CHI-FENG CHIU, INSTITUTE OF APPLIED MECHANICS, NATIONAL TAIWAN UNIVERSITY, TAIPEI 106, TAIWAN, R.O.C. COLLABORATION, DIV. OF MECHANICS, RESEARCH CENTER FOR APPLIED SCIENCE, ACADEMIA SINICA, TAIPEI 115, TAIWAN, R.O.C. COLLABORATION — The surface tension-capillary pumping is an effective driving force in a microchannel. A power-free method is explored to perform mixing in a microchannel without any external active mechanisms. The mixer is designed to have no sidewalls with the liquid being confined to flow between a bottom hydrophilic stripe and a top-covered hydrophobic substrate. It is found from both theoretical analysis and experiments that for a given channel width, the flow rate solely due to capillary pumping can be maximized at an optimal channel height. Asymmetric staggered grooved cavities are optimally arranged on the bottom substrate of the channel to enhance mixing. Furthermore, blood flows in microchannel driven by the same mechanism have been also investigated in the present study.

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