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Integrated piezoelectric vibration system for fouling mitigation in ceramic filtration membranes

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Abstract

Membranes used in separation processes are subjected to fouling which decreases the efficiency of the process and the membrane′s lifespan. To reduce this fouling, vibrating membranes made from piezoelectrics, have recently been proposed. In this study we propose an innovative and flexible design where a conventional alumina membrane vibrates under the influence of electrically driven lead zirconate titanate (PZT) piezoelectrics, which are integrated outside the filtering area. This design makes it possible to isolate the piezoelectric and electrical interconnections from the fluid during the operation. The vibration system was analysed using “hard” and “soft” PZT compositions. Both the numerical model and the measurements of the membrane vibrations in air confirmed higher vibration amplitudes in the case of the “soft” PZT. We demonstrate that the vibration system with “soft” PZT actuators also resonates under water pressure, but at amplitudes lower than those measured in air.