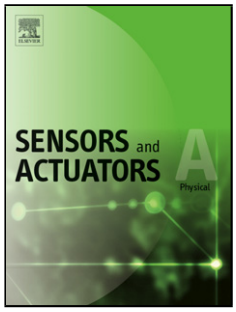

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Piezoelectric-excited membrane for liquids viscosity and mass density measurement

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Highlights:

- 1) Piezoelectric-excited membrane is presented for rapid measurement of liquids viscosity and density, especially for wide-range viscosity measurement.
- 2) High Q factor of membrane in liquids is considered helpful to improve the signal-to-noise ratio in applications.
- 3) The relationships of resonant frequency and Q factor of membrane to viscosity and density of liquids were investigated theoretically and well approved by the experimental data in a viscosity range from 19.88 cP to1,733cP and in a density range from 0.829g/cm^3 to 0.886 g/cm^3.

Abstract

This paper presents a piezoelectric-excited membrane device for rapid measurement of liquids viscosity and density. The working principle of the device is based on membrane's resonant frequency and Q factor responses to the damping effects of a surrounding liquid. The dependences of the resonant frequency and Q factor on liquids viscosity and mass density were theoretically investigated using a sphere-end oscillator model in viscous liquids and compared to experimental results. The theory and experimental results show that the piezoelectric-excited membrane can be used to measure liquids viscosity in a range from 19.88 cP to 1,733 cP and mass density in a range from 0.829 g/cm^3 to 0.886 g/cm^3. Hence, the piezoelectric-excited membrane device is a promising candidate for rapid