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Measuring porosity with air displacement volume

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One of the key factors governing the sound absorption property of material is porosity. It provides localisation of acoustic energy and also dissipates the energy. To predict the acoustic absorbing potential of material, it is essential to determine its porosity. In this work, we present the use of air displacement volume and the concept of energy conservation to determine material porosity. The system consists of two connected identical chambers. The measurement is based on the pressure difference between the two chambers that is initially isolated by a ball valve. One of the chamber is vacuumed to a certain pressure whereas the other chamber with test sample is left at atmospheric pressure. Upon the measurement, the sample chamber is excluded from the surroundings by an acrylic plate. Then chambers are open to one another, causing air flow and pressure rise in the vacuumed chamber. The pressure rise together with energy conservation allows us to calculate the porosity of the sample with the accuracy of ˜1.3%. It was also found that the accuracy can be improved by reducing the volume of the vacuumed chamber.

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