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**Determination of density by  
volumetric displacement — Skeleton  
density by gas pycnometry**

*Détermination de la masse volumique par déplacement  
volumétrique — Masse volumique du squelette mesurée par  
pycnométrie à gaz*

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## Foreword

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The committee responsible for this document is ISO/TC 24, *Particle characterization including sieving*, Subcommittee SC 4, *Particle characterization*.

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## Introduction

The true solid state density of a material is defined as the ratio of the mass to the volume occupied by that mass. Therefore, the contribution to the volume made by pores or internal voids and also interparticle voids (in the case of granulated or highly dispersed samples) shall be subtracted when calculating the true density.

If the material has no porosity, the true density can be measured by displacement of any fluid in which the solid remains inert. The accuracy of the method is limited by the accuracy with which the fluid volume can be determined. Usually, however, the pores, cracks, or crevices of the material will not easily be completely penetrated by a displaced liquid. In these instances, the true density can be measured by using a gas as the displaced fluid if the material does not contain closed pores, which cannot be penetrated by the analysis gas. Therefore, the density experimentally determined by gas pycnometry generally is the so called skeleton density of the material which equals the true solid state density only for samples without closed pores.

Apparatus used to measure solid volumes are often referred to as pyknometers or pycnometers after the Greek “pyknos”, meaning thick or dense. With gas pycnometry, materials of irregular shape can be analysed.

Once the volume of solid skeleton of the sample and the sample mass have been determined, the skeleton density is readily calculated.

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