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STANDARD

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**Uranium dioxide pellets — Determination of
density and total porosity — Mercury
displacement method**

*Pastilles de dioxyde d'uranium — Détermination de la masse volumique
et de la porosité totale — Méthode de déplacement du mercure*



Reference number
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Foreword

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Uranium dioxide pellets — Determination of density and total porosity — Mercury displacement method

1 Scope

This International Standard describes a method for determining the density and total porosity of sintered UO_2 pellets. The method can be applied to other bodies, for example green pellets, $\text{UO}_2\text{-PuO}_2$ and $\text{UO}_2\text{-Gd}_2\text{O}_3$ pellets, and also to irradiated material in hot cells. Fractured pieces of a pellet can also be tested. The mass of the specimen should not be less than about 1 g.

2 Principle

The method is based on the determination of the pellet volume by displacement of mercury which does not penetrate the open pores due to its surface tension. The density and the total porosity are determined by this volume and the mass of the pellet.

3 Apparatus

3.1 Mercury pycnometer, consisting of two chambers and a mercury collection flask. The flanges of these components of the glass apparatus are sealed with vacuum grease. (See figure 1.)

The sample should occupy at least 10 % of the volume of chamber II (see figure 1).

The purity of the mercury shall be at least 99,99 %.

NOTE 1 Excessive use of grease should be avoided to prevent errors when the joint is separated for weighing.

3.2 Vacuum system, capable of reaching a vacuum of at least 1 Pa.

3.3 Balance, with an accuracy of $\pm 0,1$ mg.

3.4 Thermometer, for measuring the temperature of mercury to the nearest 0,1 K.

4 Procedure

SAFETY PRECAUTIONS — Standard precautions shall be observed when handling uranium dioxide samples and mercury.

4.1 Calibration

The calibration of the balance shall be checked periodically according to the control plan which defines frequency and acceptable range.

4.2 Sample preparation and determination of its mass

4.2.1 Wash the pellet or the pieces of a pellet in acetone followed by ethanol.

4.2.2 Dry the sample for 1 h in a vacuum of approximately 10 Pa.

4.2.3 Determine the mass (m) of the sample to the nearest 0,1 mg.

4.3 Determination of the void volume of chamber II (see figure 1)

4.3.1 Fill chamber I with sufficient mercury to exceed the volume of chamber II. Determine the mass (m') of chamber I filled with mercury, to the nearest 0,1 mg.

4.3.2 Assemble the mercury pycnometer with the sealing flanges.