



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material 1841a

#### 200-g Silicon Density Standard

This Standard Reference Material (SRM) is intended for use as a density reference in the determination of the density of solids and liquids by means of hydrostatic weighing. This SRM is fabricated from single-crystal semiconductor-grade silicon grown by the float-zone method.

Certified Value for Density  
 $2.329074 \pm 0.000017 \text{ g/cm}^3$  at 20 °C

The certified value for density is directly traceable to the units of mass and length as defined in the International System (SI). The uncertainty value is at the 99% confidence level and includes every known source of error.

A value of  $7.68 \times 10^{-6}/\text{K}$  for the volume coefficient of expansion may be used to calculate the value for density at temperatures within the range 15 to 25 °C with negligible additional error.

Care in handling this SRM is necessary because silicon is a relatively brittle material. If the SRM should become chipped, however, the density will be unaffected because of its high degree of homogeneity. The volume of this SRM can be determined at any time by measuring its true mass; i.e.,  $\text{Volume} = \text{Mass}/\text{Density}$ .

Before use, the SRM should be cleaned with a solvent such as methanol or 1,1,1 trichloroethane. It can be manipulated either by hand, wearing a disposable polyethylene glove, or by forceps with surgical tubing covering the jaws.

The shape and size of this SRM may be altered without changing the certified density providing that all cracks which may appear are ground away and that all work damage is removed by suitable etching. See Notes on the Preparation of Silicon Density Artifacts by R.M. Schoonover, NBSIR 76-1019 (Feb. 1976) and "Determination of Silicon Density to High Precision Using a Submersible, Servo-Controlled Balance," *Metrologia* 18, 193-201 (1982) by R.S. Davis, and "A density comparison of silicon artifacts between NML (Australia) and NBS (U.S.)," *J. Res. Natl. Bur. Stand. (U.S.)*, 90, 285-287 (1985) by J.B. Patterson and R.S. Davis."

The technical direction and physical measurements leading to certification were provided by R.S. Davis of the Length and Mass Measurements and Standards Division with the guidance of C.P. Reeve of the Statistical Engineering Division on statistical questions.

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Stanley D. Rasberry, Chief  
Office of Standard Reference Materials