



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material® 1473a

#### Low Density Polyethylene Resin

This Standard Reference Material (SRM) is intended primarily for use in calibration and performance evaluation of instruments used in polymer technology for the determination of the melt flow rate. The SRM is supplied as white pellets of polyethylene in a 60 g unit.

This material is certified for melt flow rate, FR-190/2.16, using ASTM Method D 1238-90b, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer [1] Standard test condition 190/2.16. That is, the flow rate of the melt was determined at  $190.0\text{ }^{\circ}\text{C} \pm 0.1\text{ }^{\circ}\text{C}$  using a load of 2.16 kg by procedure A of the ASTM method, using a manually operated extrusion plastometer. Under these conditions [2], the certified melt flow rate for this material is as follows:

$$\text{Melt Flow Rate (FR)} = 1.17\text{ g/10 min} \pm 0.11\text{ g/10 min}$$

**Uncertainty:** The uncertainty is the numerical value of an expanded uncertainty  $U = k u_c$ , with  $U$  determined from a combined standard uncertainty,  $u_c$ , and coverage factor  $k = 2$  [3] at a level of confidence of 95 %. The standard deviation for an average single measurement is 0.015 g/10 min, with 65 degrees of freedom [2].

**Source of Material:** The supplier for this material was Quantum Chemical Corp., USI Division, Cincinnati, OH.

#### NOTICE AND WARNING TO USERS

**Expiration of Certification:** This certification will be valid for five years from the date of shipment from NIST.

**Storage:** SRM 1473a should be stored in the tightly closed, original bottle under normal laboratory conditions.

The technical coordination leading to certification of this material was provided by B.M. Fanconi of the NIST Polymers Division. Technical measurement and data interpretation were provided by J.R. Maurey, W.R. Blair, and C.M. Guttman of the NIST Polymers Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.C. Colbert.

Gaithersburg, MD 20899  
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Table 1. Estimate of Uncertainties [3] in Melt Flow Rate (FR) of SRM 1473a Polyethylene under ASTM Standard Test condition 190/2.16

Source of Uncertainty ( $u_i$ )	Type <sup>c</sup>	$u_i$ (as % of FR)
1. Uncertainty due to repeatability of experiment	A	0.16 %
2. Uncertainty due to instrument variability as estimated from $I_r$ and $I_R$ factors in precision tables in ASTM D 1238-90b	A	3.77 %
3. $u_m/m \cdot 100$ (weighing uncertainty)	B	0.04 %
4. $u_t/t \cdot 100$ (timing uncertainty)	B	0.06 %
5. $(c_T^a \cdot u_T/FR) \cdot 100$ (temp. uncertainty)	B	2.7 %
Combined standard uncertainty, $u_c^b$		4.64 %
Expanded uncertainty, $U = 2u_c$		9.3 %

<sup>a</sup>Sensitivity coefficient,  $c_T = d(FR)/dT$ , for variation of flow rate in response to small changes in melt temperature.

<sup>b</sup>The combined standard uncertainty is computed by root-sum-of-squares of the component uncertainties.

<sup>c</sup>Type of uncertainty - Type A uncertainties are evaluated by statistical methods: Type B uncertainties are evaluated by other means.

#### REFERENCES

- [1] D 1238-90b, 1994 Annual Book of ASTM Standards, Vol. 08.01, pp 272-280, (1994).
- [2] Maurey, J.R., Blair, W.R., and Guttman, C.M.: "Certification of the Standard Reference Material 1473a, A Low Density Polyethylene Resin", NISTIR 5639, (1995).
- [3] Taylor, B.N. and Kuyatt, C.E.; "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results", NIST Tech. Note 1297, September, (1994).