



Designation: D 3750 - 79 (Reapproved 1985)

Standard Practice for DETERMINATION OF NUMBER-AVERAGE MOLECULAR WEIGHT OF POLYMERS BY MEMBRANE OSMOMETRY¹

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1. Scope

1.1 This practice describes the test procedure for determining the number-average molecular weight of polymers by membrane osmometry. It is applicable to all polymers that dissolve completely without reaction or degradation to form stable solutions.

1.2 The molecular-weight range for membrane osmometry is, to some extent, a function of the particular sample-solvent-membrane system in question. A range frequently stated is 20 000 to 500 000, but this may be extended in either direction with suitable systems and by the use of special techniques.

1.2.1 The upper limit for molecular weight results from the reciprocal relationship between the quantity of interest (the molecular weight) and the quantity measured (the osmotic pressure). As the molecular weight is increased, the measured quantity becomes less, until it can no longer be measured with the required precision.

1.2.2 The lower limit for molecular weight results from diffusion of low-molecular weight species (other than the solvent) present in the sample into the solvent compartment of the osmometer. Here they do not contribute to the osmotic pressure, but do affect the equilibrium setting of the osmometer. The effect is further discussed in Section 7.

1.3 The greatest difficulty with the technique is experienced with polymer samples having a broad molecular-weight distribution that extends well into the low-molecular weight range. Such samples may exhibit the effect referred to as permeation discussed in Section 7. Note the precaution stated in 7.6.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard*

does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. A specific precautionary statement is given in 4.1.

2. Significance and Use

2.1 Molecular weight is a fundamental-structure parameter of polymers that is related to many physical properties of the bulk material, such as, tensile strength, melting point, and elasticity.

2.2 To the extent that membrane behavior is understood, membrane osmometry is an absolute measurement and may therefore be applied to polymers that have not been previously synthesized or studied. See, however, the discussion in Section 7 and Appendix X1.

3. Apparatus

3.1 *Volumetric Flasks*, 100-mL or other convenient size.

3.2 *Transfer Pipets*.

3.3 *Osmometer*—Both automated and non-automated instrument designs are in common use and differ considerably in their methods of operation. Equally valid data may be obtained with either type when properly used; the automated instruments offer considerable advantage over the nonautomated ones in convenience, ease of operation, and speed.

¹ This practice is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.70 on Analytical Methods (Section D20.70.05).

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