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Standard Test Method for MEAN MOLECULAR WEIGHT OF MINERAL INSULATING OILS BY THE CRYOSCOPIC METHOD¹

This standard is issued under the fixed designation D 2224; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

¹NOTE—Sections 1.2 and 1.3 were added editorially and changes were made throughout in November 1983.

1. Scope

1.1 This test method² covers the determination of the number average molecular weight of mineral insulating oils. The method is applicable only to those samples which have number average molecular weights between 150 and 700 and are sufficiently soluble in cyclohexane to give a freezing point depression of at least 0.4°C.

1.2 The values stated in acceptable metric units are to be regarded as the standard.

1.3 *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.*

2. Summary of Method

2.1 The depression in the freezing point of a solvent caused by a known weight of the sample as solute is determined and the molecular weight calculated by applying Raoult's law.

NOTE 1—The cryoscopic method is, in general, reliable only if the solute is chemically inert toward the solvent, if true solution takes place, if no mixed crystals or solid solutions are formed during freezing, and if no association of the solute or solvation between solute and solvent occurs.

3. Significance and Use

3.1 The molecular weight is a basic quantity required in many kinds of analytical and technological projects involving petroleum products. It is needed to convert weight fractions to mole

fractions, and is desirable when characterizing petroleum fractions by means of a hydrocarbon-type analysis.

4. Apparatus (see Fig. 1)

4.1 *Cooling Bath*—A large jar of capacity sufficient to contain ample cooling medium. The bath shall be maintained at a constant temperature, about 5°C below the freezing point of the solution. An ice-water mixture is suitable for this method.

4.2 *Outer Tube*—A resistance-glass test tube, closed by a synthetic rubber stopper carrying the inner tube, and containing a cork ring to support the inner tube.

4.3 *Inner Tube*—A resistance-glass test tube, closed by a cork carrying the thermometer and guide for the stirrer.

4.4 *Thermometer*, of the Beckmann type, and subdivided into graduations not greater than 0.01°C, and readable, with the aid of a lens, to 0.001°C. Each 0.5°C interval on the scale shall not be in error by more than 0.005°C, and corrections for the scale errors, preferably certified by the NBS, shall be applied. A mechanical arrangement for regularly tapping the thermometer is desirable.

4.5 *Stirrer*, of glass or other inert material,

¹ This test method is under the jurisdiction of ASTM Committee D-27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.07 on Physical Test.

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² This method is based on IP Standard 86/44 (Tentative) of the Institute of Petroleum.