



Standard Practice for Rubber—Identification by Pyrolysis-Gas Chromatography¹

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This standard has been approved for use by agencies of the Department of Defense.

PART 1. IDENTIFICATION OF SINGLE POLYMERS

1. Scope

1.1 This practice is a guide to the identification of polymers in raw rubbers, and cured and uncured compounds, based on a single polymer, by the gas chromatographic patterns of their pyrolysis products (pyrograms). Implementation of this guide presupposes a working knowledge of the principles and techniques of gas chromatography, sufficient to carry out this practice and to interpret the results correctly.²

1.2 This practice will identify the following polymers:

- 1.2.1 Polyisoprene of natural or synthetic origin,
 - 1.2.2 Butadiene-styrene copolymers,
 - 1.2.3 Polybutadiene,
 - 1.2.4 Polychloroprene,
 - 1.2.5 Butadiene-acrylonitrile copolymers,
 - 1.2.6 Ethylene-propylene copolymers and related terpolymers, and
 - 1.2.7 Isobutene-isoprene copolymers.
- 1.3 This practice will not differentiate the following polymers:

- 1.3.1 Natural polyisoprene from synthetic polyisoprene.
- 1.3.2 Butadiene-styrene copolymers produced by solution and emulsion polymerization. It is sometimes possible to distinguish butadiene-styrene copolymers containing different amounts of styrene as well as random polymers from block polymers.
- 1.3.3 Polybutadiene with different microstructures.
- 1.3.4 Different types of polychloroprenes.
- 1.3.5 Butadiene-acrylonitrile copolymers with different monomer ratios.
- 1.3.6 Ethylene-propylene copolymers with different monomer ratios, as well as the copolymers from the related terpolymers.
- 1.3.7 Isobutene-isoprene copolymers (butyl rubbers) from halogenated butyl rubbers.

1.3.8 Polyisoprene containing different amounts of *cis-trans* isomers.

1.3.9 The practice does not identify ebonite or hard rubbers.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

- D 297 Test Methods for Rubber Products—Chemical Analysis³
- E 260 Practice for Packed Column Gas Chromatography⁴
- E 355 Practice for Gas Chromatography Terms and Relationships⁴

3. Significance and Use

3.1 For research, development, and quality control purposes, it is advantageous to determine the composition of rubbers in cured, compounded products.

3.2 This practice provides such composition analysis, utilizing a gas chromatograph and pyrolysis products from rubber decomposition.

4. Principle of the Practice

4.1 This practice is based upon comparison of the gas chromatographic pattern of the pyrolysis products of a known rubber with an unknown rubber. The results of this separation will hereafter be referred to as the pyrogram.

4.2 The pyrogram of the known rubber is filed for future reference. The pyrogram of the unknown rubber is compared to this for identification.

4.3 The success of the method depends upon examining the known and unknown rubbers under exactly the same experimental conditions.

¹ This practice is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.11 on Chemical Analysis.

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² Definitions of terms and general directions for the use of gas chromatography may be found in Practices E 355 and E 260.

³ *Annual Book of ASTM Standards*, Vol 09.01.

⁴ *Annual Book of ASTM Standards*, Vol 03.06.