



Designation: D 4474 – 00

Standard Classification System for Styrenic Thermoplastic Elastomer Injection Molding and Extrusion Materials (TES)¹

This standard is issued under the fixed designation D 4474; 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.

INTRODUCTION

This classification system is intended to be a means of calling out materials used in the fabrication of end items or parts. It is not intended for the selection of materials. Material selection should be made by those having expertise in the plastics field after careful consideration of the design and performance required of the part, the environment to which it will be exposed, the fabrication process to be employed, the inherent properties of the material other than those covered by this classification system, and the economics.

1. Scope*

1.1 This classification and subsequent line callout (specification) cover styrenic block copolymer thermoplastic elastomer materials for injection molding and extrusion. Copolymers consist of polystyrene segments bound to rubbery segments. The rubbery segments may be saturated or unsaturated. Compounding ingredients may be present as necessary for the application. The compounding ingredients may consist of reinforcements, resins, plasticizers, fillers, stabilizers, and colorants. Recycled styrenic thermoplastic elastomers are not covered in this classification.

1.2 The properties included in this classification are those required to identify the compositions covered. There may be other requirements necessary to identify particular characteristics that are important to specialized applications. These may be described by using the suffixes specified in Section 5.

1.3 The values stated in SI units, as detailed in IEEE/ASTM SI 10, are to be regarded as the standard.

NOTE 1—There is no equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:²

- D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D 618 Practice for Conditioning Plastics for Testing

¹ This classification system is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

Current edition approved Nov. 10, 2000. Published February 2001. Originally published as D 4474 – 85. Last previous edition D 4474 – 96.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D 883 Terminology Relating to Plastics
- D 1600 Terminology for Abbreviated Terms Relating to Plastics
- D 1898 Practice for Sampling of Plastics³
- D 2240 Test Method for Rubber Property—Durometer Hardness
- D 3892 Practice for Packaging/Packing of Plastics³
- D 4000 Classification System for Specifying Plastic Materials³
- D 5740 Guide for Writing Material Standards in the Classification D 4000 Format
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specification
- IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System

3. Terminology

3.1 Definitions:

3.1.1 For definitions of technical terms pertaining to plastics used in this classification, see Terminology D 883.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *styrenic thermoplastic elastomer (TES)*— a copolymer material comprising styrenic end-block segments which are bound to a rubbery segment that may be saturated or unsaturated and which normally contain substantial amounts of added materials such as other polymers, oils, fillers, and colorants.

³ Withdrawn.

*A Summary of Changes section appears at the end of this standard.

3.2.2 *unsaturated styrenic thermoplastic elastomer (TESU)*—a copolymer material comprising styrenic end-blocks which are bound to an unsaturated rubbery segment.

3.2.3 *saturated styrenic thermoplastic elastomer (TESS)*—a copolymer material comprising styrenic end-blocks which are bound to a saturated rubbery segment.

3.2.4 *thermoplastic elastomers (TPE)*—a diverse family of rubber-like materials that, unlike conventional vulcanized rubbers, can be processed and recycled like thermoplastic materials.

4. Classification

4.1 Styrenic thermoplastic elastomer materials are classified into groups according to their basic composition. These groups are subdivided into classes and grades as shown in Table TES.

4.1.1 An example of this classification system is as follows: The designation TES 0112 would indicate TES = thermoplastic elastomerstyrenic, as found in Terminology D 1600, 01 (group) = saturated rubber, 1 (class) = low hardness, and 2 (grade) with requirements given in Table TES.

4.1.2 To facilitate the incorporation of future or special materials, the “other/unspecified” category (0) for group, class, and grade is shown in Table TES. The basic properties can be obtained from Table A.

4.2 Styrenic thermoplastic elastomers suitable for injection molding and extrusion are fully compounded materials of a

proprietary nature. Consequently, there is no distinction between reinforced and unreinforced versions. This part of the callout is omitted.

4.3 Specific requirements shall be shown by a six character designation. The designation will consist of the letter A and the five digits comprising the cell numbers for the property requirements in the order as they appear in Table A.

4.3.1 Although the values listed are necessary to include the range of properties available in existing materials, users should not infer that every possible combination of the properties exists or can be obtained.

4.3.2 An example of this classification system is as follows: The designation TES 0110 A22240 would indicate the following, with the material requirements from Table A:

TES 0110 = Styrenic saturated thermoplastic elastomer having low hardness from Table TES.

- A = Table A property requirements,
- 2 = 50 Durometer A hardness, min,
- 2 = 50 MPa flexural modulus, min,
- 2 = 5.0 MPa tensile strength, min,
- 4 = 500 % elongation, min, and
- 0 = Unspecified.

If no properties are specified, the designation would be TES 0110 A00000.

TABLE TES Detail Requirements for Styrenic Thermoplastic Elastomers

Group	Description	Class	Description	Grade	Description	Hardness, ASTM D 2240, A/D Durometer Typical	Flexural Modulus, ASTM D 790, min, MPa	Tensile Strength, ASTM D 412, min, MPa	Elongation, (Ultimate) ASTM D 412, min, %	Tear Resistance, ASTM D 624, Die C, min, KN/m	Specific Gravity, ASTM D 792, ± 0.02,										
01	Saturated rubber segment	1	Low hardness	1	Other	47A	<10	3.0	500	13	1.19										
				2		55A	<10	9.0	600	15	0.92										
				3		59A	11	4.0	500	16	1.20										
				0																	
				2		Medium hardness	1	Other	82A	52	7.8	450	47	1.01							
				2			89A		130	3.9	300	21	1.86								
		3	91A	125	9.0		450		36	1.14											
		0																			
		3	High hardness	1	Other	45D	480	11	400	50	1.20										
		2		44D		310	12	400	70	1.14											
		3		49D		360	4.1	200	26	1.83											
		4		57D		450	15	500	85	1.02											
		5		60D		520	13	350	98	0.91											
		6		64D		1480	15	350	76	1.29											
		0																			
0	Other																				
02	Unsaturated rubber segment	0	Other	Other	Other	Other	Other	Other	Other	Other	Other										
												1	Low hardness	0	Other	0	Other	0	Other	0	Other
												2		0		0		0			
												0		0		0		0			
												3	High hardness	1	Other	47D	250	6.7	300	52	1.05
0																					
0	Other																				
00	Other	0	Other	Other	Other	Other	Other	Other	Other	Other	Other										
												0									