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Thermoplastic elastomers — Nomenclature and abbreviated terms

Élastomères thermoplastiques — Nomenclature et termes abrégés

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 249, *Plastics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 18064:2014), which has been technically revised.

The main changes are as follows:

— inclusion of TPO co-polymers;

— differentiation between single polymers and compounds;

— unification of expressions.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Thermoplastic elastomers combine many of the attributes and features of both vulcanized thermoset rubber and thermoplastic materials. It is, therefore, important that any system of classification and nomenclature for this rapidly expanding polymer sector be acceptable to both the rubber and plastics industries. Neither of the existing International Standards for the nomenclature and abbreviated terms for rubber (ISO 1629) and for plastics (ISO 1043-1) is suitable for this purpose. The system in this document has been devised to avoid any conflict or ambiguity, permit the use of existing terms in the construction of abbreviated terms for thermoplastic elastomers, and allow for future developments or expansion.

This document uses established abbreviated terms. Its aim is both to prevent the occurrence of more than one abbreviated term for a given thermoplastic elastomer term, and to prevent the interpretation of more than one meaning for a given abbreviated term. For this reason, this document makes appropriate use of the terms and symbols listed in ISO 1043-1 and ISO 1629.

Thermoplastic elastomers — Nomenclature and abbreviated terms

1 Scope

This document establishes a nomenclature system for thermoplastic elastomers based on the chemical composition of the polymer or polymers involved. It specifies symbols and abbreviated terms used to identify thermoplastic elastomers in industry, commerce, and government. It is not intended to conflict with, but to supplement, existing trade names and trademarks.

NOTE 1 The name of the thermoplastic elastomer is intended to be used in technical papers and presentations followed by the abbreviated term used to designate the elastomer in this document.

NOTE 2 Annex A gives thermoplastic-elastomer abbreviated terms that have been used in the past in materials standards, technical bulletins, textbooks, patents, and trade literature.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1629, *Rubber and latices — Nomenclature*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
thermoplastic elastomer
TPE
polymer or blend of polymers that has properties at its service temperature similar to those of vulcanized rubber but can be processed and reprocessed at elevated temperature like a thermoplastic

Note 1 to entry: TPE are elastomers as specified in ISO 1382 and ISO 472. An elastomer shows recovery after elongation.

4 Nomenclature system

4.1 The prefix TP is used to indicate that the abbreviated term is for a thermoplastic elastomer and shall be followed by a letter representing each category of thermoplastic elastomer, as detailed in Clause 5.

4.2 The abbreviated term for each category of thermoplastic elastomer shall be followed, after a hyphen, by a combination of symbols to describe a specific member of each category, as detailed in Clause 6.

4.3 If the TPO and TPS are compounded with other polymers, "-M" is added after the letters describing the main polymer.

5 Categories of thermoplastic elastomer

5.1 TPA

Thermoplastic polyamide elastomer, consisting of a block copolymer of alternating hard and soft segments with amide chemical linkages in the hard segments and ester, ether or carbonate chemical linkages or mixtures of them in the soft segments.

5.2 TPC

Thermoplastic copolyester elastomer, consisting of a block copolymer of alternating hard segments and soft segments with ester linkages in the hard segments and ester, ether or carbonate chemical linkages or mixtures of them in the soft segments.

5.3 TPO

This category comprises the following two definitions:

Thermoplastic polyolefin elastomer, consisting of a block copolymer of alternating hard segments and soft segments where all segments have an olefinic or aliphatic structure.

Thermoplastic polyolefin elastomer mixture, consisting of a blend of a polyolefin and a conventional non-vulcanized rubber and the rubber phase in the blend having little or no crosslinking.

5.4 TPS

Thermoplastic polystyrene elastomer, consisting of at least a triblock copolymer of styrene and a specific diene, where the two end segments, i.e. the hard segments, are polystyrene and the internal soft segment is a polydiene or hydrogenated polydiene.

5.5 TPU

Thermoplastic polyurethane elastomer, consisting of a block copolymer of alternating hard and soft segments with urethane chemical linkages in the hard segments and ether, ester or carbonate chemical linkages or mixtures of them in the soft segments.

5.6 TPV

Thermoplastic elastomer vulcanizate, consisting of a blend of a thermoplastic material and a conventional rubber in which the rubber has been crosslinked by the process of dynamic vulcanization during the blending and mixing step.

5.7 TPZ

Unclassified thermoplastic elastomer, comprising a polymer compound by any composition or structure other than those grouped in TPA, TPC, TPO, TPS, TPU, and TPV.

6 Materials in each TPE category

6.1 TPA

The category of TPA is sub-categorized into groups according to the linkages in the soft segments. The following symbols are used:

TPA-EE soft segment with both ether and ester linkages;

TPA-ES polyester soft segment;

TPA-ET polyether soft segment;

TPA-CE polycarbonate soft segment.

6.2 TPC

The category of TPC is sub-categorized into groups according to the linkages in the soft segments. The following symbols are used:

TPC-EE soft segment with ester and ether linkages;

TPC-ES polyester soft segment;

TPC-ET polyether soft segment;

TPC-CE polycarbonate soft segment.

6.3 TPO

The category of TPO is sub-categorized into groups as follows:

A TPO block copolymer is represented by the suffix –C for “copolymer”.

A specific blended TPO (i.e. not a copolymer) is identified by a bracketed term comprising the standard abbreviated term for the thermoplastic type according to ISO 1043-1, a “+” sign and the standard abbreviated term for the rubber type according to ISO 1629.

Examples for TPO symbols are as follows:

TPO-C block copolymer;

TPO-M (PP+EPDM) polymer mixture, equivalent to blend, of polypropylene with ethylene-propylene-diene terpolymer, with no or little crosslinking of the EPDM phase.

6.4 TPS

This category is sub-categorized into fully-hydrogenated “TPS-H” or only partially and non-hydrogenated “-N”. The following symbols are used:

TPS-H fully-hydrogenated soft segment;

TPS-N partially or non-hydrogenated soft segment.

NOTE For the user it is not relevant to know which kind of copolymer is taken for the application. The highest impact on properties comes from the amount of unsaturated linkages.

6.5 TPU

The category of TPU is sub-categorized into types according to the aromatic or aliphatic nature of the urethane linkages of the hard segments, and according to the chemical linkages (ether, ester, carbonate) in the soft segments. The following symbols are used:

TPU-ARES aromatic hard segment, polyester soft segment;

TPU-ARET aromatic hard segment, polyether soft segment;

TPU-AREE aromatic hard segment, soft segment with ester and ether linkages;

TPU-ARCE aromatic hard segment, polycarbonate soft segment;

TPU-ALES aliphatic hard segment, polyester soft segment;

TPU-ALET aliphatic hard segment, polyether soft segment;

TPU-ALEE aliphatic hard segment, soft segment with ester and ether linkages;

TPU-ALCE aliphatic hard segment, polycarbonate soft segment.

NOTE The previous version of this document contained TPU-ARCL for caprolactone soft segment. This is incorporated into the ester TPU-ARES and ALES.

6.6 TPV

The category of TPV varies depending on the nature of the thermoplastic as continuous phase and the dispersed rubber component in the system.

A specific TPV is identified by a bracketed term comprising the standard abbreviated term for the thermoplastic type according to ISO 1043-1, followed by a "+" sign and the standard abbreviated term for the rubber according to ISO 1629.

Examples, for TPV type symbols are as follows:

TPV-(PP+ EPDM) combination of EPDM and polypropylene in which the EPDM phase is highly crosslinked and finely dispersed in a continuous PP phase;

TPV-(PP+NBR) combination of acrylonitrile-butadiene rubber and polypropylene in which the NBR phase is highly crosslinked and finely dispersed in a continuous PP phase;

TPV-(PA+ACM) combination of acrylate rubber and polyamide in which the ACM phase is highly crosslinked and finely dispersed in a continuous PA phase;

TPV-(TPU+QR) combination of silicone rubber and thermoplastic polyurethane in which the QR phase is highly cross-linked and finely dispersed in a continuous TPU phase.

NOTE The thermoplastic is put first to indicate that it has the main effect on the mechanical properties.

6.7 Miscellaneous material (TPZ)

These thermoplastic elastomers do not fit into any of the classes named above and are identified by the prefix TPZ, followed by the abbreviated term of the main polymer partners. The continuous phase is put first.

An example for a TPZ symbol is as follows:

TPZ-(PVC+NBR) blend of polyvinyl chloride and acrylonitrile-butadiene rubber.