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BSI Standards Publication

# Rubber — Framework for assessing the environmental fate of tyre and road wear particles (TRWP)



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# National foreword

This Published Document is the UK implementation of ISO/TS 22687:2018.

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# Rubber — Framework for assessing the environmental fate of tyre and road wear particles (TRWP)

*Caoutchouc — Lignes directrices pour évaluer le devenir environnemental des particules émises par l'usure des pneumatiques et de la route*



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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).

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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.*

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

Tyres are complex consumer goods comprised of several reactive chemical additives that assist in the manufacture and function of the product. These formulated chemical additives are transformed by rubber curing processes during the manufacturing lifecycle stage. Subsequently, the remaining additives and transformation products are released from tyre tread during the service life (tyre use) stage as a component of tyre and road wear particles (TRWP), which are formed from the friction between a tyre and roadway surface (Kreider et al. 2010). TRWP contain tyre tread and pavement encrustations, and when released from tyre tread to soil and sediment ecosystems, are exposed to abiotic weathering and other environmental transformation processes. During the end-of-life stage, the additives and their transformation products in TRWP in soil or sediment have the potential to leach or become environmentally available (bioaccessible), and subsequently release into the surrounding ecosystem. As such, there is interest in studying the fate and transformations of tyre chemical additives from manufacture to the end-of-life in aquatic and sediment ecosystems (Unice et al. 2015).

Reliable analytical methods including polymer extraction methods accelerated weathering protocols, and leaching and incubator test specifications, are available to quantitatively assess the environmental processes affecting tyre additive fate in the manufacturing, service life, and end-of-life lifecycle stages. The key processes affecting the fate of additive chemicals during the lifecycle of a tyre include chemical transformations during rubber curing, physical and chemical changes during TRWP generation, abiotic and biotic transformations during TRWP weathering, leaching and sediment deposition. These processes cumulate during the lifecycle to determine the leachable or environmentally available fraction of tyre additive. The leachable fraction is the fraction of the formulated tyre chemical additive in the tread that is leached to surface water from TRWP released to soil or sediment, inclusive of pore and overlying water. The environmentally available fraction is the fraction of the formulated tyre chemical additive in the tread that is bioaccessible from TRWP in aqueous media, inclusive of overlying water, pore water and isopropanol extracted sediment.

These guidelines describe a general framework and considerations for the assessment of the leachable and environmentally available (or bioaccessibility) fraction of formulated functional tyre additives. Knowledge of the environmental fate and transport of tyre chemicals can assist in future analysis regarding the toxicity of TRWP to aquatic organisms. This framework may be useful for other complex, matrix-bound consumer products.

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**TECHNICAL SPECIFICATION** **ISO/TS 22687:2018**

# Rubber — Framework for assessing the environmental fate of tyre and road wear particles (TRWP)

## 1 Scope

This document establishes a general framework and considerations for assessing the environmental fate of tyre tread chemical additives in cured polymer and tyre and road wear particles (TRWP) throughout a tyre lifecycle. This document is applicable to laboratory-generated TRWP from cured tread polymer of known composition.

Testing strategies are described for assessing the environmental fate and transport of tyre chemicals in the following processes that can occur during the tyre lifecycle:

a) transformation of chemical additives in tread during tyre curing;

b) transformation of chemical additives during TRWP generation (tyre use);

c) transformation of chemical additives during TRWP aging and weathering;

d) leaching of chemical additives and transformation products from TRWP to water;

e) availability of chemical additives and transformation products from TRWP in sediment ecosystems.

Mass concentrations and fractions of chemicals released or available from TRWP for the five lifecycle steps are used to estimate

a) cumulative fraction of tread chemical(s) and transformation product(s) released to water, and

b) cumulative fraction tread chemical(s) and transformation products(s) environmentally available.

## 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/TS 22638, *Rubber — Generation and collection of tyre and road wear particles (TRWP) — Road simulator laboratory method*

ISO/TS 22640, *Rubber — Framework for physical and chemical characterization of tyre and road wear particles (TRWP)*

## 3 Terms and definitions

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

ISO and IEC maintain terminological 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/



 