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**Plastics — Determination of the  
molecular mass and molecular mass  
distribution of polymer species by  
matrix-assisted laser desorption/  
ionization time-of-flight mass  
spectrometry (MALDI-TOF-MS)**

*Plastiques — Détermination de la masse moléculaire et de la  
distribution des masses moléculaires des polymères par spectrométrie  
de masse, à temps de vol, après désorption/ionisation laser assistée  
par matrice (SM-MALDI-TOF)*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://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](http://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 on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

This second edition cancels and replaces the first edition (ISO 10927:2011), which has been technically revised to update [Figure 1](#) and [6.7](#) on data handling.

## Introduction

The molecular mass and molecular mass distribution of a synthetic polymer are fundamental characteristics that result from the polymerization process. They may be used for a wide variety of correlations for fundamental studies and for processing and product applications. Determination of the molecular mass and molecular mass distribution is used for quality control of polymers and for specification purposes in the commerce of polymers. The comparability of MALDI-TOF-MS results obtained in different laboratories can be ensured by using standardized conditions of measurement, identical samples and identical matrix preparation methods. The classification of MALDI-TOF-MS as an equitable (standardized) method compared with other established methods of polymer characterization could result in a significant increase in the use of MALDI-TOF-MS.



# Plastics — Determination of the molecular mass and molecular mass distribution of polymer species by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF-MS)

## 1 Scope

This document specifies a general method for determining the average molecular mass and molecular mass distribution of polymers (see Reference [1]) from  $2\,000\text{ g}\cdot\text{mol}^{-1}$  to  $20\,000\text{ g}\cdot\text{mol}^{-1}$  by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF-MS).

The average molecular masses and molecular mass distributions are calculated from a calibration curve constructed using synthetic-polymer and/or biopolymer standards. This method is therefore classified as a relative method.

The method is not applicable to polyolefins or to polymers with a polydispersity  $>1,2$ .

## 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 472, *Plastics — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

### 3.1

#### **matrix-assisted laser desorption/ionization time-of-flight-mass spectrometry MALDI-TOF-MS**

mass-spectrometric technique in which the separation is based on different flight times in a field free flight tube depending on the mass of formed polymer ions after ionization by a laser, desorption and acceleration by high voltage

### 3.2

#### **number-average molecular mass**

$M_n$

$$M_n = \frac{\sum_{i=1}^{\infty} (N_i \times M_i)}{\sum_{i=1}^{\infty} N_i}$$

where  $N_i$  is the number of molecules of species  $i$  of molecular mass  $M_i$