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**Reinforced plastics based on  
unsaturated-polyester resins —  
Determination of the residual styrene  
monomer content, as well as the content  
of other volatile aromatic hydrocarbons,  
by gas chromatography**

*Plastiques renforcés à base de résines de polyesters non saturés —  
Détermination du styrène monomère résiduel, ainsi que d'autres  
hydrocarbures aromatiques volatils, par chromatographie en phase  
gazeuse*



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ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 4901 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 12, *Thermosetting materials*.

This second edition cancels and replaces the first edition (ISO 4901:1985), which has been technically revised (for details, see the Introduction).

## Introduction

During the 25 years since publication of the first edition of this International Standard, ISO 4901:1985, significant advances have been made in analytical techniques such as gas chromatography. The standard has therefore been completely revised. The following are the main changes which have been made:

- a) In addition to a gas-chromatographic method, the first edition of ISO 4901 included, as an alternative, a classical method, Wijs' method, based on an iodometric titration. This method had been included in the first edition for laboratories in which gas chromatography was not available. As, nowadays, chromatography is considered to be a routine analytical tool, Wijs' method has been removed from the standard.
- b) Packed gas-chromatography columns have generally been replaced by open, tubular columns which operate under completely different conditions. In the revised test method, therefore, only an open, tubular column is used.
- c) In addition, the gas-chromatographic method has been extended to cover not only styrene but also other aromatic hydrocarbons which might have been used as solvents or starting materials in producing the unsaturated polyester resin.



# Reinforced plastics based on unsaturated-polyester resins — Determination of the residual styrene monomer content, as well as the content of other volatile aromatic hydrocarbons, by gas chromatography

**WARNING** — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory requirements.

## 1 Scope

This International Standard specifies a method for the determination, by gas chromatography, of the residual styrene monomer in reinforced plastics based on unsaturated polyester (UP) resins in the polymerized state. The residual styrene monomer content is an important criterion in evaluating the degree of cure of UP resins in the polymerized state. The method can also be used for the simultaneous determination of other volatile aromatic hydrocarbons in UP resins.

The method is not applicable to UP resins of high chemical resistance.

## 2 Normative references

The following referenced documents are indispensable for the application 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*

ISO 1172, *Textile-glass-reinforced plastics — Prepregs, moulding compounds and laminates — Determination of the textile-glass and mineral-filler content — Calcination methods*

## 3 Terms and definitions

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

## 4 Principle

Styrene is extracted from the UP resin in the polymerized state using dichloromethane. The styrene in the extract is determined by gas chromatography, using an internal standard and a calibration curve.