



Plastics — Phenolic resins — Basis for classification

Plastiques — Résines phénoliques — Définitions pour classification

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ISO/TR 8244 was prepared by Technical Committee ISO/TC 61, *Plastics*.

The reasons which led to the decision to publish this document in the form of a Technical Report type 2 are explained in the Introduction.

0 Introduction

This Technical Report gives an overview of the different types of phenolic resin used in the manufacture of thermosetting plastics. It provides detailed descriptions of these resins and other pertinent information, and adds to the definitions given in the related International Standard ISO 472.

UDC 678.632

Ref. No. ISO/TR 8244 : 1988 (E)

Descriptors: plastics, thermosetting resins, phenoplasts, classifications, definitions.

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Printed in Switzerland

Price based on 4 pages

1 Scope and field of application

1.1 This Technical Report defines terms relating to the chemical structure of phenolic resins, their physical state and their degree of condensation and polycondensation, for classification purposes in the manufacture and processing of these resins.

1.2 The definitions apply to all fields of application of phenolic resins in plastics. (See also related definitions in ISO 472.)

2 Reference

ISO 472, *Plastics — Vocabulary*.

3 Basis for classification

3.1 The term “phenolic resins” as used in this Technical Report refers to

- a) synthetic resins or modified products obtained by condensation of phenol with aldehydes, particularly formaldehyde;
- b) products of the addition of phenols to unsaturated compounds (for example acetylene, terpenes and natural resins).¹⁾

NOTE — Resins in which the original properties are so changed by the modification (for example by rosin) that they resemble more closely those of the modifying medium are not regarded as phenolic resins.

3.2 Phenolic resins may be classified in a number of ways, such as by

- a) the type of raw material (see clause 4);
- b) the type of resin produced (see clause 5);
- c) the type of modifying agent (see 5.2);
- d) the physical form of the commercial product (see clause 6);
- e) the degree of condensation (see clause 7);
- f) the type of catalyst (see 8.1 and 8.2);
- g) the type of hardener (see 8.2).

4 Raw materials

4.1 Phenols

Besides unsubstituted phenol, derivatives of phenol used for the manufacture of phenolic resins include cresols, xylenols and other alkylphenols (for example *p-tert*-butylphenol, *p-tert*-octylphenol and *p-tert*-nonylphenol), arylphenols (for example phenylphenol and naphthols) and divalent phenols (such as resorcinol and bisphenol A).

4.2 Aldehydes

The most important aldehyde component is formaldehyde, which is used in various forms, including aqueous solution and solid paraformaldehyde, and also as compounds which give rise to formaldehyde. Other aldehydes (for example acetaldehyde, acrolein, benzaldehyde and furfural) are employed to a more limited extent, as also are ketones.

5 Types of phenolic resin

5.1 Unmodified phenolic resins

Unmodified phenolic resins are produced by condensation reactions of phenols with an aldehyde. Depending on factors such as the volume and molar ratio of the raw materials, the reaction conditions and the catalysts employed, two different classes of product are obtained: novolaks and resols.

1) Strictly speaking, these resins are not what are normally regarded as resins for the production of plastics. They are used particularly in certain surface coatings.