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Nanotechnologies — Polymeric nanocomposite films for food packaging with barrier properties — Specification of characteristics and measurement methods

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National foreword

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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).

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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 229, *Nanotechnologies*.

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

The rapid market growth of emerging packaging containing nano-objects is due to the effects this packaging has on improving food shelf life and decreasing food waste. In addition, the increasing export and import of food and food products is creating a growing future demand for nano-enhanced packaging.

Typical plastics used for packaging are polyethylene, polypropylene, polyamide and polyester. The presence of nano-objects in packaging can enhance various characteristics of the polymeric films such as gas/water vapour barrier properties, UV-Vis light transparency, thermal properties and mechanical strength. One of the key purposes of such packaging is to deliver longer shelf life by improving the barrier properties of food packaging to reduce gas diffusion, water vapour exchange and UV-Vis light exposure[1]. The effect of gas, water vapour and UV-Vis light permeability of food packaging on the shelf life is described in Annex A. Various types of nano-objects, such as clay nanoplatelets, zinc oxide nanoparticles/nanorods, titanium oxide nanoparticles, have been incorporated into the polymeric matrix to improve the above-mentioned barrier properties.

In contrast to glass or metal packaging materials, polymeric materials are permeable to small molecules of gas(es) and water vapour as well as UV-Vis light. The possibility to improve the barrier properties of polymer packaging by the application of nanocomposites is a very attractive field. The principal factors affecting the permeability of the original polymer matrix and the nanocomposite are the crystallinity and crystal phases of the polymer, the state of dispersion and orientation of nano-objects in the nanocomposite, etc. (see Annexes B and C).

In general, for a successful application of nano-enhanced barrier food packaging, it is required:

— to define the relationship among composition, structure and properties;

— to identify characteristics and their measurement methods.

This document specifies the characteristics including barrier properties to be measured of polymeric nanocomposite films. It also recommends the relevant measurement methods for the characteristics. This document is expected to promote communication and mutual understanding of polymeric nanocomposites for food packaging applications between buyers and sellers.

TECHNICAL SPECIFICATION ISO/TS 21975:2020

Nanotechnologies — Polymeric nanocomposite films for food packaging with barrier properties — Specification of characteristics and measurement methods

1 Scope

This document specifies characteristics including barrier properties to be measured of polymeric nanocomposite films used for improving food packaging. The barrier properties cover gas (oxygen), water vapour transmission and UV-Vis light transparency. This document also describes the relevant measurement methods.

This document addresses neither safety and health issues related to the food packaging nor environmental aspects.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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 http://www.electropedia.org/

3.1.1
glass transition temperature
characteristic value of the temperature range over which the glass transition takes place

Note 1 to entry: Glass transition is a reversible change in an amorphous polymer or in amorphous region of partially crystalline polymer between a viscous or rubbery condition and a hard and relatively brittle one.

[SOURCE: ISO 11357-2:2020, 3.1, modified — Note 1 to entry has been replaced.]

3.1.2
melting temperature
temperature range over which crystalline or *semi-crystalline polymers* (3.1.7) lose their crystalline characteristics or particulate shape to produce a liquid, when heated

[SOURCE: ISO 472:2013, 2.584, modified — The definition has been reworded.]

3.1.3
nanocomposite
solid comprising a mixture of two or more phase-separated materials, one or more being nanophase

Note 1 to entry: Polymer matrix nanocomposite is referred to nanocomposite with at least one major polymeric phase.

[SOURCE: ISO/TS 80004-4:2011, 3.2, modified — Note 1 to entry has replaced the original Notes 1 and 2 to entry.]