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Imaging materials — Optical discs — Care and handling for extended storage

Matériaux pour l'image — Disques optiques — Précautions et manipulation pour stockage étendu

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 18938:2008), which has been technically revised.

Introduction

In addition to storage conditions, the proper care and handling of optical discs is also vital to prolonged disc life. This is becoming increasingly important as optical discs are widely used for the recording and storage of information. This International Standard gives guidelines for their recommended care and handling and will be beneficial for all digital optical discs, regardless of their inherent stability.

NOTE It is recognized that both "optical discs" and "optical disks" are acceptable spellings. In this International Standard, the former spelling is used.

Probably no form of data storage has been accepted and adopted as rapidly as the optical disc. It has become the medium of choice for numerous applications with ever increasing use for the recording and storage of information. Information is recorded in digital format that not only provides high storage density, but also allows duplication without information loss, ease of data manipulation and facilitates transmission. It is of tremendous benefit for audio usage since it permits uninterrupted playback for long periods of time. Information in a disc format can be accessed very quickly, unlike that in a roll format such as magnetic tape, which requires longer search time.

While the advantages are many, as with other media, there are nevertheless concerns about the life expectancy of recorded information on optical discs. This depends upon three independent components, namely the permanence of the disc itself, the disc drive and the software. Obsolescence of the disc drive and software, lack of playback device or inoperability of the playback device are all serious uncertainties. Another important issue is the quality of the initial data recorded onto the disc, which needs to be as high as possible. In addition, the very popularity of recordable optical discs has led to their wide availability, and wide variability in the quality of discs for long term preservation of information. Many discs may not be of sufficient quality for long term use.

The finite life of optical discs is well recognized and one approach to addressing this issue is by periodically transferring or reformatting the information. In addition, the ability to play back a disc in the future depends on the existence of functional playback equipment. As newer formats and equipment become popular, equipment manufacturers will probably discontinue production and support of the older, superseded equipment. Eventually, usable equipment to play obsolete optical disc formats will become difficult to find. Before this occurs, it is advisable that a migration plan be in place. However, these issues are outside the scope of this International Standard, which is only concerned with the stability of the optical disc itself. A primary objective of those involved with the preservation of information on this media is to ensure that the disc is not the weak link among the necessary components. To support this objective, it is advisable that steps be taken to maximize the optical disc's potential to be more stable than either the hardware or the software.

As with paper records, photographic film and magnetic tape, optical discs are subject to both damage and decay. They have a finite life. Predictions of the life expectancy of optical discs have involved extrapolations of property retention after high temperature and humidity incubations back to practical conditions. These extrapolations follow mathematical treatments that were developed for simpler chemical reactions, and therefore the results need to be interpreted with some caution. Predictions cover a very wide range, from 25 years to over 250 years, which vary with the manufacturer and the disc type. Their effective life can be increased or decreased significantly depending upon the conditions under which they are stored. Storage recommendations for optical discs are given in ISO 18925. Following these recommendations promotes the physical integrity of the media and increases their effective life.

Imaging materials — Optical discs — Care and handling for extended storage

1 Scope

This International Standard establishes general principles for the care and handling of digital optical discs during use. It addresses the issues of physical integrity of the medium necessary to preserve access to the recorded data (information). This International Standard includes recommendations for handling procedures to maximize the effective life of optical discs. Faulty handling, packing and transporting techniques and methods often cause physical damage to the discs and to the content recorded thereon. Extending the longevity of optical discs requires the identification of appropriate handling methods, as well as well-developed and implemented training programs.

For the purposes of this International Standard, the term “optical disc” includes the families of compact disc (CD), digital versatile disc (DVD), high definition digital versatile disc (HD DVD) and Blu-ray disc (BD)[1)], and any hybrids of these families. The term “optical disc” also includes each type of disc within a family, including injection moulded [read-only memory (ROM)], dye-layer [recordable (R)] and phase change [rewritable (RW, RE), random access memory (RAM), and recordable (BD-R)] technologies.

While some of the recommendations in this International Standard (e.g. those for staff training) apply specifically to large-scale or long term usage, the basics of all recommendations in this International Standard are intended to be applied in circumstances where the desired result is long-term usage of the medium whether archival, commercial or personal.

This International Standard does not cover magneto-optical (MO) discs, laser discs (LD) or glass discs. At the time of writing, International Standards do not exist for HD DVD and Blu-ray discs. Nonetheless, it is believed that the recommendations in this International Standard for care and handling can equally apply to them. It is recognized that some of these requirements are not necessarily possible for the individual user to achieve.

The following are within the scope of this International Standard:

— use and handling environments, including pollutants, temperature and humidity and light exposure;

— contamination concerns;

— inspection;

— cleaning and maintenance, including cleaning methods and frequency;

— transportation;

— disasters, including water, fire, construction and post-disaster procedures;

— staff training.

The quality of the data written on the disc is outside the scope of this International Standard. However, a high quality result of the recording phase is important to the longevity of information. It is advisable that a rigorous program of data integrity testing be implemented, as this forms an obligatory part of all digital long-term storage. In addition, when keeping digital information for archival purposes, it is advisable that a multiple copy/multiple location strategy be in place.

1) Blu-ray Disc™ and Blu-ray™ are trademarks of Blue-ray Disc Association, and Blu-ray Disc and HD DVD are examples of suitable products available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration*

ISO 18925, *Imaging materials — Optical disc media — Storage practices*

3 Terms and definitions

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

3.1
acclimatization staging
process of conditioning material from one set of temperature-moisture conditions to another

3.2
balance
precision vertical position of the disc as it spins

3.3
blister
localized delamination that looks like a bubble

3.4
Blu-ray Disc
BD
optical disc having a cover layer around 0,1 mm thick and a substrate around 1,1 mm thick on which data is read or recorded by an OPU using 405 nm laser diode and NA = 0,85 lens

3.4.1
Blu-ray Disc Read Only Memory
BD-ROM
optical disc to which information is transferred during manufacture to moulded areas in the Blu-ray disc format and can be read multiple times by an optical beam

3.4.2
Blu-ray Disc Recordable
BD-R
recordable optical disc in which information can be recorded once to areas in the Blu-ray disc format and read many times

3.4.3
Blu-ray Disc Rewritable
BD-RE
recordable optical disc in which information can be recorded to areas in the Blu-ray disc format and can be erased, rerecorded and read many times

3.5
carton
box outer container that can hold one or more individual units and can be a fabrication of paper, card stock or plastic

3.6
compact disc
CD
optical disc in which the information layer is located near one surface of a substrate and the data can be read by an optical beam with a wave length of 780 nm

Note 1 to entry: Described in IEC 60908.

3.6.1
CD read only memory
CD-ROM
optical disc to which information is transferred during manufacture to moulded areas in the compact disc format and can be read multiple times by an optical beam

Note 1 to entry: Described in ISO/IEC 10149.

3.6.2
CD Recordable
CD-R
recordable optical disc in which information can be recorded once to areas in the compact disc format and read many times

3.6.3
CD Rewritable
CD-RW
rewritable optical disc in which information can be recorded to areas in the compact disc format and can be erased, rerecorded and read many times

3.7
conditioning
exposure of a material to air at a given relative humidity and temperature until equilibrium is reached

3.8
container
box, can or carton used for storage and shipping of recording materials

EXAMPLE The box into which a reel, cassette, cartridge or shell is placed.

3.9
delamination
separation of a laminate into its constituent layers

3.10
digital versatile disc
DVD
optical disc in which one or more information layers are located between two substrates and the data can be read by an optical beam with a wave length of 650 nm

Note 1 to entry: Formerly called digital video disc.

3.10.1
DVD read only memory
DVD-ROM
optical disc in which information is transferred during manufacture to certain areas in the DVD format and can be read multiple times by an optical beam

Note 1 to entry: Described in ISO/IEC 16448 and ISO/IEC 16449.

3.10.2
DVD Recordable
DVD-R, +R
recordable optical disc in which information can be recorded once to areas in the DVD format and read many times

Note 1 to entry: Described in ISO/IEC 23912, ISO/IEC 17344 and ISO/IEC 25434.

3.10.3
DVD Rewritable
DVD-RAM, DVD-RW, +RW
DVD optical discs that can be written, read and overwritten many times using phase change technology

Note 1 to entry: Described in ISO/IEC 17592, ISO/IEC 17341 and ISO/IEC 26925.

3.11
enclosure
case, cartridge, folder, envelope, sleeve or clam shell that is intended for physical protection against mechanical damage

3.12
extended-term storage conditions
storage conditions suitable for the preservation of recorded information having permanent value

3.13
high definition digital versatile disc
HD DVD
optical disc in which one or more information layers are located between two substrates and the data can be read by an optical beam with a wave length of 405 nm

Note 1 to entry: Sometimes called high density digital versatile disc.

3.13.1
HD DVD read only memory
HD DVD-ROM
optical disc in which information is transferred during manufacture to certain areas in the HD DVD format and can be read multiple times by an optical beam

3.13.2
HD DVD recordable
HD DVD-R
recordable optical disc in which information can be recorded once to areas in the HD DVD format and read many times

3.13.3
HD DVD rewritable
HD DVD-RW
HDDVD optical discs that can be written, read and overwritten many times using phase change technology

3.14
information
data recorded using the system

3.15
insulated record container
storage box designed to provide an environmental buffer against temperature and humidity fluctuations

3.16
jewel case
plastic enclosure featuring a hinged lid and one or more trays, each containing a hub clamp to secure and protect the disc surface

3.17
keep case
case designed for DVD discs slightly larger than a jewel case

3.18
macroenvironment
atmospheric conditions in a large area in which records are kept

Note 1 to entry: Atmospheric conditions are temperature, relative humidity and pollutants.

3.19
medium
material on which information is recorded

3.20
microenvironment
atmospheric conditions inside a storage enclosure in which records are kept

Note 1 to entry: Atmospheric conditions are temperature, relative humidity and pollutants.

3.21
optical disc
disc that will accept and retain information from light modulation changes in a recording or reflective layer that can be read with an optical beam

3.22
optical disc cartridge
ODC
optical disc enclosure required for the operation of the disc

3.23
recording layer
layer of an optical disc on which data is written either during manufacture or in use

3.24
relative humidity
RH
ratio, defined as a percentage, of the existing partial vapour pressure of water to the vapour pressure at saturation

Note 1 to entry: It is usually, but not always, equal to the percentage of the amount of moisture in the air to that at saturation.

3.25
replicated disc
disc made by an injection moulding process where the land and pits that make up the data are physically pressed into the polycarbonate

3.26
retrievability
ability to access information as recorded

3.27
slimline case
slimmer version of the jewel case

3.28
snapper case
alternative to the keep case with a cardboard cover

3.29
storage environment
conditions for storing materials

Note 1 to entry: The conditions are temperature, relative humidity, cleanliness of facilities and atmospheric pollutants.

3.30
storage housing
physical structure supporting materials and their enclosures

Note 1 to entry: It can consist of drawers, racks, shelves or cabinets.

3.31
substrate
layer which may be transparent or not, provided for the mechanical support of the recording layer

3.32
system
combination of media, hardware, software and documentation necessary for recording and/or retrieving information

3.33
WORM disc
optical disc in which the data in specified areas can be written only once and read multiple times by an optical beam

4 Composition of optical discs

4.1 General

Optical discs are composed of a series of layers made of different materials assembled like a sandwich. Typically, these layers include the polycarbonate substrate (plastic) layer(s), the data layer(s), the metal layers(s) or reflective layer, the metal protective layers, the adhesive layer and an optional extra layer for labelling or added protection. These layers are listed in Annex A.

4.2 Polycarbonate substrate (plastic) layer

The polycarbonate substrate makes up most of the disc. The polycarbonate is typically clear, but may be coloured for appearance or to prevent copyright infringement. The laser beam of a disc drive travels through this substrate for CD, DVD and HD DVD and through the cover layer for BD. The substrate provides the layer depth necessary to maintain laser focus for CD, DVD and HD DVD. The substrate also gives the disc enough strength to remain flat for CD, DVD, HD DVD and BD.

A CD is one continuous 1,2 mm thick polycarbonate layer. Both DVDs and HD DVDs are made up of two 0,6 mm thick polycarbonate layers bonded together. BDs are made up of 1,1 mm thickness polycarbonate layer and 0,1 mm thickness cover layer. CDs and BDs are read from one side only. DVDs and HD DVDs are read from one or both sides.

4.3 Data layer

As its name implies, the data layer of optical discs is the layer that contains the encoded data. The encoded data appear as marks or pits that either transmit or alter light from the laser beam back to the laser photosensor by way of the metal reflective layer. Write-once (–R, +R) discs use organic dye material or phase change materials, whereas rewritable (–RW, +RW, –RAM, –RE) discs use phase change

