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Rare earth — Packaging and labelling

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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).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 298, *Rare earth*.

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 purpose of this document is to ensure quality assurance, enhanced safety and pollution prevention during the global trade of rare earth products.

Rare earth products (ores, concentrates, compounds, metals and alloys) have some unique chemical and physical properties. For example, some rare earth products can readily react with O₂, CO₂ and moisture. In addition, some rare earth products, such as monazite, can emit radiation because they contain thorium and uranium. Under certain circumstances, these features can result in accidents or create hazards (explosion, fire, downgrading the quality of products, radiation exposure, etc.) during transportation and storage. Indeed, several such incidents have been reported and these emphasize the possibility of harm to human health, pollution to the environment and a reduction in product quality. Such problems are likely to have global effects because rare earth products are transported across borders.

It is necessary to package rare earth products properly. It is also essential to share clearly defined information, in a readily accessible format, concerning their physical properties and traceability during global trade. This document provides requirements that will ensure proper packaging and appropriate labelling of rare earth products. Proper packaging can prevent rare earth products from losing their quality and causing accidents resulting from unwanted chemical reactions. Appropriate labelling with precise information on the properties, traceability and the ways of handling the product can also reduce the risk of quality degradation and accidents. Conforming to this document will contribute to ensuring quality, guaranteeing safety and preventing environmental pollution during the global trade of rare earths.

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NOTE There are numerous existing regulations concerning the packaging, labelling and shipment of materials. Depending on circumstances, such regulations can include References [6] to [23]. In addition, local regulations concerning shipments, transport and packaging can also apply. Many jurisdictions require that a safety data sheet (SDS) accompany any shipment.

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Rare earth — Packaging and labelling

1 Scope

This document specifies requirements and recommendations for the packaging and labelling of rare earth ores, concentrates, compounds, metals and alloys that are intended for sale or free distribution. It defines the performance and structure of packaging, and specifies the information to include on the labelling. These requirements and recommendations are designed to ensure quality assurance, enhance safety and prevent environmental pollution during the transportation and storage of rare earth products.

This document is applicable to packaging and labelling during transactions between companies. It does not include packaging by companies during storage in their own plant.

The method of labelling defined in this document enhances safety by indicating properties of rare earth products and ensures appropriate management of the product by indicating the identity of suppliers.

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 21067-1, *Packaging — Vocabulary — Part 1: General terms*

ISO 22444-1, *Rare earth — Vocabulary — Part 1: Minerals, oxides and other compounds*

ISO 22444-2, *Rare earth — Vocabulary — Part 2: Metals and their alloys*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21067-1, ISO 22444-1, ISO 22444-2 and the following apply.

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

supplier

company that produces and provides rare earth ores, concentrates, compounds, metals, alloys or solutions for its customer

Note 1 to entry: It includes the mines, beneficiation plants, hydrometallurgical plants, traders/brokers/blenders of rare earth products.

3.2

inner packaging

container designed to come into direct contact with the product

3.3

intermediate packaging

packaging placed between the *inner packaging* (3.2) and *outer packaging* (3.4) if deemed necessary

3.4

outer packaging

container designed to contain inner or *intermediate packaging* (3.3) including any protective materials where required

3.5

protecting gas

shielding gas

gas used in packaging that will displace oxygen and water vapour and will not react with the package contents, and will therefore prevent product degradation and chemical reaction

EXAMPLE Argon, nitrogen.

3.6

protecting liquid

oil or other liquid used as coating on, or to totally submerge, a product to isolate it from air and ensure quality stability

Note 1 to entry: It is usually used in the packaging of rare earth target products.

3.7

vacuum

device to remove air from the package before sealing

3.8

minimum packaging unit

smallest independent unit for sales and delivery, where items/products cannot be broken up

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4 Packaging

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4.1 General principles of packaging

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Packaging for rare earth products should prevent the products from being accidentally dispersed or otherwise discharged into the environment and from absorbing moisture or gases. Solid rare earth metals and compounds can react with water, water vapour and other gases, causing damage to the quality of products, exothermic reaction and ignition. For these reasons, a sealed package should be used to contain solid rare earth products. Rare earth liquid products can flow out of the packaging if a package loses its integrity, causing potential damage to products, workers and surroundings. For these reasons, durable packaging should be used. This clause specifies requirements and recommendations for packaging appropriate to the properties of the rare earth product, including ores, concentrates, compounds, metals, alloys and solutions (see [Annex A](#) for additional information on the chemical characteristics of rare earth products and key information related to packaging and labelling).

Within each minimum packaging unit, products should be of the same batch, grade, specification and form. In the case of different batches of products put in the same minimum packaging unit, they should be separately packaged with clear identification to avoid mixing of products.

4.2 Requirements and recommendations for packaging

4.2.1 Inner (and intermediate) packaging

4.2.1.1 Polymer bottles

Polymer bottles are vessels made from polymer, having a comparatively narrow neck or mouth, with closure and usually no handle. They should have a load-bearing capacity depending on the content and the polymer should be chemically compatible.

4.2.1.2 Glass bottles

Glass bottles are rigid vessels made from borosilicate glass, having a comparatively narrow neck or mouth, with a closure and usually no handle. They should have load-bearing capacity depending on the content.

4.2.1.3 Polymer film bags

Polymer film bags are flexible containers made of polymer layers, generally enclosed on all sides except one, forming an opening that is sealed after filling. They should have load-bearing capacity depending on the content and should be chemically compatible.

4.2.1.4 Aluminized polymer bags

Aluminized polymer bags are flexible containers made from polymer film metallized with aluminium, which reduces the permeability of the polymer film to the external atmosphere. They may be used as inner or intermediate packaging for some rare earth metals and their alloys (such as cerium and cerium alloy). They should have a load-bearing capacity depending on the content and should be chemically compatible.

4.2.2 Outer packaging

4.2.2.1 Metal drums

Metal drums are cylindrical vessels made from iron, steel or alloys whose bottom end is permanently fixed to the body. The top-end (head) is either removable or non-removable. Steel drums with a capacity of over 200 l used for rare earth product packaging should meet the requirements specified in ISO 15750-1, ISO 15750-2 and ISO 15750-3. Steel drums with a capacity of less than 200 l used for rare earth product packaging should have load-bearing capacity depending on the content and should be chemically compatible or else an appropriate inner package should be used.

4.2.2.2 Polymer drums

Polymer drums are cylindrical vessels made from polymer whose bottom end is permanently fixed to the body. The top-end (head) is either removable or non-removable. They should have load-bearing capacity depending on the content and should be chemically compatible or else an appropriate inner package should be used.

4.2.2.3 Flexible containers

Flexible containers are containers made from a flexible material that are collapsible when empty. Flexible intermediate bulk containers used for rare earth products packaging should meet the requirements given in ISO 21898.

4.2.2.4 Polymer bulk containers

Polymer bulk containers are vessels made from polymer, designed to contain liquids, pastes or powders. They should have load-bearing capacity depending on the content and should be chemically compatible or an appropriate inner package used.

4.2.2.5 Corrugated fibreboard boxes

Corrugated fibreboard boxes consist of one or more fluted paper sheets glued to a flat sheet of board or between several sheets. They should have load-bearing capacity depending on the content and should be chemically compatible or else an appropriate inner package should be used.

4.2.2.6 Kraft bags

Kraft bags are flexible containers made from paper made using the kraft process and are generally enclosed on all sides except one, forming an opening that may or may not be sealed after filling. They should have load-bearing capacity depending on the content and should be chemically compatible or else an appropriate inner package should be used.

4.2.2.7 Wooden/plywood drums or containers

Drums or containers made of wood/plywood and with a top-end (head) that can be removed. They can be used as outer packaging for rare earth products. They should have load-bearing capacity depending on the content and should be chemically compatible or else an appropriate inner package should be used.

4.3 Requirements and recommendations for packaging of rare earth products

4.3.1 Rare earth ore

In most cases, there are no special requirements for packaging ore. Consideration should be given to the use of flexible containers under special circumstances. Regarding those ores with a certain level of radioactivity, dust-tight flexible containers or polymer film bags should be used and the radioactivity on the outside surface of the packaging should take into account the requirements of the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA) (see References [6], [8], [12], [13], [14], [16] and [17]).

4.3.2 Rare earth concentrate

Flexible containers with a dust-tight integral liner should be used for the outer packaging.

4.3.3 Rare earth compound

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4.3.3.1 Oxide

Some rare earth oxide powders can react with moisture or carbon dioxide in the air and form hydroxides or carbonates or become deliquescent. Rare earth oxides shall be sealed in an airtight and waterproof package. Polymer bottles or polymer film bags should be used for the inner package. Steel drums, polymer drums, flexible containers, polymer bulk containers, corrugated fibreboard boxes, kraft bags or wooden/fibreboard drums should be used for the outer package.

4.3.3.2 Salts and other compounds

4.3.3.2.1 In solid-state

Most rare earth salts and compounds are in the form of dry powder, granules or solid blocks. They are usually chemically stable, but most can absorb moisture and become deliquescent. Suitable packaging should be used depending on their chemical characteristics. Instructions for packaging of typical rare earth compounds are provided in [Table 1](#).

Table 1 — Instructions for packaging of typical solid rare earth salts and compounds

Type	Instructions for			Remarks
	inner packaging	intermediate packaging	outer packaging	
Carbonate	waterproof and airtight package	polymer bottles, polymer film bags or glass bottles	corrugated fibreboard boxes, steel drums, flexible containers, kraft bags or wooden/plywood drums	
Chloride^a				
Hydroxide				
Fluoride				
Nitrate^a				
Sulfate^a				
Oxalate				
Acetate^a	waterproof package	polymer bottles or polymer film bags	corrugated fibreboard boxes	
Phosphate	no special requirement	no special requirement	no special requirement	polymer drums or polymer bulk containers can be used as a single package
Sulfide				
Citrate				
Hexaboride				
^a These products can be traded as a solid or in solution.				

4.3.3.2.2 Aqueous solutions

Many rare earth salts can be dissolved in water to form an aqueous solution, including chloride, nitrate, acetate and sulfate. A solution of rare earth salt is usually chemically stable and often acidic. It shall be kept in a corrosion-proof package. Polymer bottles or polymer bulk containers should be used for the inner package of smaller shipments. Corrugated fibreboard boxes should be used for the outer package. Polymer drums or polymer bulk containers are recommended as the single package for larger shipments.

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4.3.4 Rare earth metal and alloy

Most rare earth metals and some of their alloys are chemically reactive. They can react with oxygen in the air and become oxidized on the surface. The reactivity varies greatly for different rare earth metals, and even for the same metal or its alloy depending on its physical form. Therefore, the packaging requirements are variable depending on the chemical characteristics. The rare earth metal or its alloy shall be sealed in a protecting gas atmosphere or in a vacuum. Instructions for the packaging of rare earth metals and their alloys are provided in [Table 2](#).

Table 2 — Instructions for packaging of typical rare earth metals and their alloys

Type	Instructions for			Remarks
	inner packaging	intermediate packaging	outer packaging	
Rare earth metals and alloys in bulk (block, ingot/slab, wire and sheet)	polymer film bags or aluminized polymer bags	polymer film bags	steel drums or corrugated fibreboard boxes	Seal in an inner package in a protecting gas atmosphere, or in a vacuum, or in a protecting liquid; the pressure of the protecting gas shall be kept above atmospheric pressure or in a vacuum low enough to prevent degradation. Packaging for cerium (UN 1333) and ferro-cerium (UN 1323) shall take Reference [18] into account.