

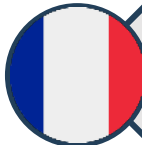




# Updates from ISO/TCs on Critical Materials



# ISO Critical Mineral Technical Committees

The US participates in multiple ISO/TCs; increased US industry engagement is needed to regain US leadership in standards for: mining, separation/processing, traceability, analysis methods, labeling, recycle/reuse

-  ISO/TC 298 Rare earth
-  ISO/TC 333 Lithium
-  ISO/TC 345 Materials for specialty technologies
-  ISO/TC 82/SC 7 Sustainable mining and mine closure
-  ISO/TMB Critical Mineral Coordination Committee\*

\*no US participation

# ISO/TC 298 Rare Earth Overview

**Scope:** Standardization in the field of rare earth mining, concentration, extraction, separation and conversion to useful rare earth compounds/materials (including oxides, salts, metals, master alloys, etc.) which are key inputs to manufacturing and further production process in a safe and environmentally sustainable manner.



ISO/TC 298/CAG ⓘ Chair's Advisory Group



ISO/TC 298/JWG 6 ⓘ Sustainability



ISO/TC 298/WG 2 ⓘ Elements recycling



ISO/TC 298/WG 3 ⓘ Traceability, Packaging and Labelling



ISO/TC 298/WG 4 ⓘ Testing and Analysis



ISO/TC 298/WG 7 ⓘ Product specification

15

Published ISO standards \*

7

ISO standards under development \*

20

Participating members

20

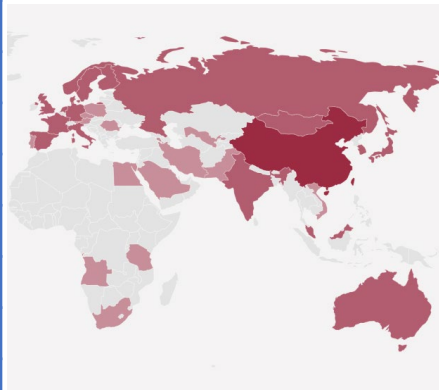
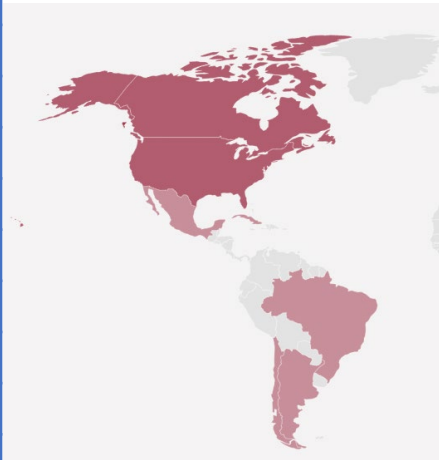
Observing members

# ISO/TC 298 Membership

## Participating

## Observer

Australia	<a href="#">SA</a>
Canada	<a href="#">SCC</a>
China	<a href="#">SAC</a>
Denmark	<a href="#">DS</a>
Finland	<a href="#">SFS</a>
France	<a href="#">AFNOR</a>
Germany	<a href="#">DIN</a>
India	<a href="#">BIS</a>
Italy	<a href="#">UNI</a>
Japan	<a href="#">JISC</a>
Korea, Republic of	<a href="#">KATS</a>
Malaysia	<a href="#">DSM</a>
Mongolia	<a href="#">MASM</a>
Netherlands	<a href="#">NEN</a>
Norway	<a href="#">SN</a>
Russian Federation	<a href="#">GOST R</a>
Spain	<a href="#">UNE</a>
Sweden	<a href="#">SIS</a>
United Kingdom	<a href="#">BSI</a>
United States	<a href="#">ANSI</a>



Angola	<a href="#">INIQ</a>
Argentina	<a href="#">IRAM</a>
Armenia	<a href="#">ARMSTANDARD</a>
Austria	<a href="#">ASI</a>
Brazil	<a href="#">ABNT</a>
Chile	<a href="#">INN</a>
Cuba	<a href="#">NC</a>
Czech Republic	<a href="#">UNMZ</a>
Egypt	<a href="#">EOS</a>
Iran, Islamic Republic of	<a href="#">INSO</a>
Mexico	<a href="#">DGN</a>
Pakistan	<a href="#">PSQCA</a>
Poland	<a href="#">PKN</a>
Portugal	<a href="#">IPQ</a>
Romania	<a href="#">ASRO</a>
Saudi Arabia	<a href="#">SASO</a>
South Africa	<a href="#">SABS</a>
Tanzania, United Republic of	<a href="#">TBS</a>
Uzbekistan	<a href="#">O'ZTTSA</a>
Viet Nam	<a href="#">STAMEQ</a>

# ISO/TC 298 Rare Earth Liaisons

To TC 298	Title	From TC 298	Title
IEC/TC 111	Environmental standardization for electrical and electronic products and systems	IEC/TC 68	Magnetic alloys and steels
ISO/TC 82	Mining	IEC/TC 111	Environmental standardization for electrical and electronic products and systems
ISO/TC 82/SC 7	Sustainable mining and mine closure	ISO/IEC JTC 1/SC 27	Information security, cybersecurity and privacy protection
ISO/TC 102/SC 1	Sampling	ISO/TC 37	Language and terminology
ISO/TC 206	Fine ceramics	ISO/TC 79	Light metals and their alloys
ISO/TC 315	Cold chain logistics	ISO/TC 82	Mining
ISO/TC 321	Transaction assurance in E-commerce	ISO/TC 102/SC 1	Sampling
ISO/TC 333	Lithium	ISO/TC 132	Ferroalloys
ISO/TC 334	Reference materials	ISO/TC 154	Processes, data elements and documents in commerce, industry and administration
ISO/TC 345	Materials for specialty technologies	ISO/TC 206	Fine ceramics
<b>Org. (Cat)</b>	<b>Title</b>	ISO/TC 207	Environmental management
EC (B)	European Commission	ISO/TC 207/SC 5	Life cycle assessment
ECOS (A)	Environmental Coalition on Standards	ISO/TC 308	Chain of custody
ILiA (A)	International Lithium Association	ISO/TC 321	Transaction assurance in E-commerce
OGC (A)	Open Geospatial Consortium, Inc.		
REIA (A)	Rare Earth Industry Association		

# ISO/TC 298 U.S. Technical Advisory Group

## TAG Stakeholders / Participation

General Interest	Producer Interest	Public Sector/SDOs
Northeastern Univ.	MP Materials	NIST/DOC
Univ. of Wyoming	Noveon	U.S. DOE (NETL, ANL, INL)
Actolan	USA Rare Earth	U.S. EPA
Amphenol-Sensors	Electron Energy	MI Geological Survey
Grace		CSA Group
		NEMA

# ISO/TC 298 Rare Earth Standards

[ISO 22444-1:2020](#) Rare earth — Vocabulary — Part 1: Minerals, oxides and other compounds

[ISO 22444-2:2020](#) Rare earth — Vocabulary — Part 2: Metals and their alloys

[ISO 22927:2021](#) Rare earth — Packaging and labelling

[ISO 23664:2021](#) Traceability of rare earths in the supply chain from mine to separated products

[ISO 17887:2025](#) Traceability of rare earths in the supply chain from separated products to permanent magnets

[ISO 5976:2025](#) Rare earth — Determination of loss on ignition in rare earth products — Gravimetric method

[ISO 23596:2023](#) Rare earth — Determination of rare earth content in individual rare earth metals and their compounds — Gravimetric method

[ISO 24548:2025](#) Rare earth — Determination of moisture content in rare earth products — Gravimetric method

[ISO 23597:2023](#) Rare earth — Determination of rare earth content in individual rare earth metals and their oxides — Titration method

[ISO 22928-1:2024](#) Rare earth — Analysis by wavelength dispersive x-ray fluorescence spectrometry (WD-XRFS) — Part 1: Determination of composition of rare earth magnet scrap using standardless XRF commercial packages

[ISO 24181-1:2024](#) Rare earth — Determination of non-rare earth impurities in individual rare earth metals and their oxides — ICP-AES — Part 1: Analysis of Al, Ca, Mg, Fe and Si

[ISO 22450:2020](#) Recycling of rare earth elements — Requirements for providing information on industrial waste and end-of-life products

[ISO/TS 22451:2021](#) Recycling of rare earth elements — Methods for the measurement of rare earth elements in industrial waste and end-of-life products

[ISO 22453:2021](#) Exchange of information on rare earth elements in industrial wastes and end-of-life cycled products

[ISO 24544:2024](#) Rare earth — Recyclable Neodymium iron boron (NdFeB) resources — Classification, general requirements and acceptance conditions

Vocabulary

Traceability

Analysis

Recycling  
End of Life

# ISO/TC 298 Rare Earth Standards

Vocabulary

[ISO 22444-1:2020](#) – Rare earth — Vocabulary — Part 1: Minerals, oxides and other compounds

[ISO 22444-2:2020](#) – Rare earth — Vocabulary — Part 2: Metals and their alloys

[ISO/DIS 24468](#) [Under development] Praseodymium-neodymium metal

Traceability

[ISO 22927:2021](#) – Rare earth — Packaging and labelling

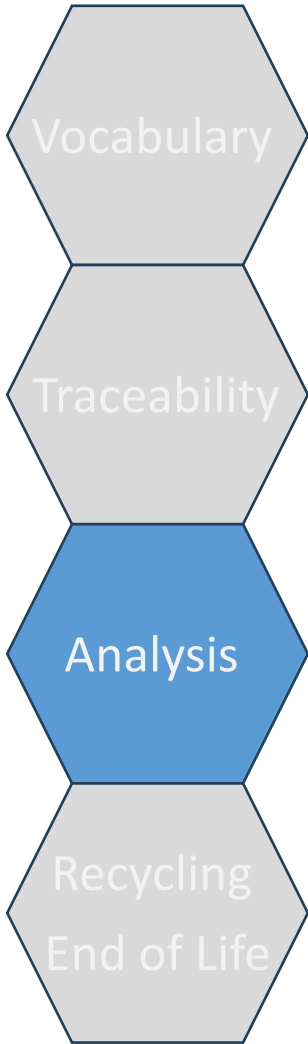
[ISO 23664:2021](#) – Traceability of rare earths in the supply chain from mine to separated products

[ISO 17887:2025](#) – Traceability of rare earths in the supply chain from separated products to permanent magnets

Analysis

Recycling  
End of Life

# ISO/TC 298 Rare Earth Standards



[ISO 5976:2025](#) Rare earth — Determination of loss on ignition in rare earth products — Gravimetric method

[ISO 23596:2023](#) Rare earth — Determination of rare earth content in individual rare earth metals and their compounds — Gravimetric method

[ISO 24548:2025](#) Rare earth — Determination of moisture content in rare earth products — Gravimetric method

[ISO 23597:2023](#) Rare earth — Determination of rare earth content in individual rare earth metals and their oxides — Titration method

[ISO 22928-1:2024](#) Rare earth — Analysis by wavelength dispersive x-ray fluorescence spectrometry (WD-XRFS) — Part 1: Determination of composition of rare earth magnet scrap using standardless XRF commercial packages

[ISO 24181-1:2024](#) Rare earth — Determination of non-rare earth impurities in individual rare earth metals and their oxides — ICP-AES — Part 1: Analysis of Al, Ca, Mg, Fe and Si

[WD 19456](#) [Under development]

Determination of rare earth impurity contents in individual rare earth metals and their oxides — Inductively coupled plasma mass spectrometry Part 1: Determination of rare earth impurity contents in individual La, Ce, Pr, Nd, Sm metals and their oxides

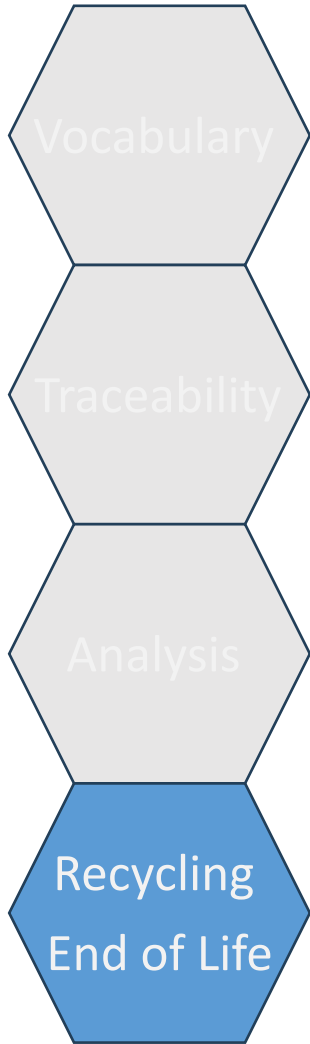
[AWI 24880](#) [Under development]

Rare earth — Determination of rare earth distribution in mixed rare earth metals and their compounds- Inductively coupled plasma optical emission spectrometry

[AWI 24890](#) [Under development]

Rare Earth — Analysis by X-Ray Fluorescence Spectrometry (XRFS) --Determination of rare earth distribution in praseodymium-Neodymium compounds by Borate Fusion

# ISO/TC 298 Rare Earth Standards



[ISO 22450:2020](#) Recycling of rare earth elements — Requirements for providing information on industrial waste and end-of-life products

[ISO/TS 22451:2021](#) Recycling of rare earth elements — Methods for the measurement of rare earth elements in industrial waste and end-of-life products

[ISO 22453:2021](#) Exchange of information on rare earth elements in industrial wastes and end-of-life cycled products

[ISO/DIS 24457](#) [Under development] Specifications for short loop recycling of neodymium iron boron sintered permanent magnets

[ISO 24544:2024](#) Rare earth — Recyclable Neodymium iron boron (NdFeB) resources — Classification, general requirements and acceptance conditions

NP 26020 Rare earth — Specification for removal of coating layers on surface of neodymium iron boron permanent magnet

PWI 24887 Recycled sintered neodymium iron boron permanent magnets with physical recycling methods: classification, code, and general requirements

PWI 26234 Rare earth – Pre-assessment and sorting of recyclable NdFeB resources

# ISO/TC 298 Rare Earth Standards (JWG6)



Entire Value  
Chain

[ISO/WD 24961](#) [Under development] Rare earths and lithium sustainability across the value chain











[ISO/CD 25191](#) [Under development] Rare Earth – Guidance for data collection and validation for the calculation of carbon footprint

# TC 298 – Rare Earth – Activities

- **Plenary meeting:** Delft (NE), August 31 – September 4
  
- Scope: review of Strategic Business Plan
- Impact: Critical material, gaps in supply chains
- Standards users: manufacturers, testing labs
- Conformity assessment: quality systems, certified testing labs
- IBR (inclusion by reference): voluntary adoption
- Systematic Reviews:
  - ISO 22444-1:2020 – REE vocabulary (minerals/oxides)
  - ISO 22444-2:2020 – REE vocabulary (metals/alloys)
  - ISO 22450:2020 – REE recycling information requirements
  - ISO 22453:2021 – REE waste/EoL information exchange – pending
  - ISO 22927:2021 – REE packaging/labeling – pending

# ISO/TC 333 Lithium Overview

**Scope:** Standardization in the field of lithium mining, concentration, extraction, separation and conversion to useful lithium compounds/materials (including oxides, salts, metals, master alloys, lithium-ion battery materials, etc.) The work program includes terminology, technical conditions of delivery to overcome transport difficulties, unified testing and analysis methods to improve the general quality of lithium products.

	ISO/TC 333/CAG – Chair’s Advisory Group	ISO/TC 333/WG 4 – Analysis for lithium electrolyte	
	ISO/TC 333/AHG 1 – Analysis methods	ISO/TC 333/WG 6 – Analysis for lithium cathode materials	
	ISO/TC 333/WG 1 – Lithium vocabulary	ISO/TC 333/WG 7 – Analysis for lithium chloride	
	ISO/TC 333/WG 2 – Chemical analysis for lithium hydroxide	ISO/TC 333/WG 8 – Chemical analysis for lithium mineral	
	ISO/TC 333/WG 3 – Chemical analysis for lithium carbonate	ISO/TC 333/WG 9 – Carbon footprint for lithium product	

1

Published ISO standard \*

18

ISO standards under development \*

23

Participating members

12

Observing members

# ISO/TC 333 Membership

## Participating

Argentina	<a href="#">IRAM</a>
Australia	<a href="#">SA</a>
Belgium	<a href="#">NBN</a>
Bolivia, Plurinational State of	<a href="#">IBNORCA</a>
Brazil	<a href="#">ABNT</a>
Canada	<a href="#">SCC</a>
Chile	<a href="#">INN</a>
China	<a href="#">SAC</a>
Congo, The Democratic Republic of the	<a href="#">OCC</a>
Finland	<a href="#">SFS</a>
France	<a href="#">AFNOR</a>
Germany	<a href="#">DIN</a>
Iran, Islamic Republic of	<a href="#">INSO</a>
Japan	<a href="#">JISC</a>
Korea, Republic of	<a href="#">KATS</a>
Mongolia	<a href="#">MASM</a>

Peru	<a href="#">INACAL</a>
Portugal	<a href="#">IPQ</a>
Russian Federation	<a href="#">GOST R</a>
Sweden	<a href="#">SIS</a>
Switzerland	<a href="#">SNV</a>
United Kingdom	<a href="#">BSI</a>
United States	<a href="#">ANSI</a>

## Observer

Austria	<a href="#">ASI</a>
Czech Republic	<a href="#">UNMZ</a>
India	<a href="#">BIS</a>
Italy	<a href="#">UNI</a>
Mexico	<a href="#">DGN</a>
Netherlands	<a href="#">NEN</a>
New Zealand	<a href="#">NZSO</a>
Poland	<a href="#">PKN</a>
Spain	<a href="#">UNE</a>
Syrian Arab Republic	<a href="#">SASMO</a>
Uzbekistan	<a href="#">O'ZTTSA</a>
Zimbabwe	<a href="#">SAZ</a>



# ISO/TC 333 Lithium Liaisons

To TC 333	Title	From TC 333	Title
IEC/SC 21A	Secondary cells and batteries containing alkaline or other non-acid electrolytes	IEC/TC 21A	Secondary cells and batteries containing alkaline or other non-acid electrolytes
IEC/TC 35	Primary cells and batteries	IEC/TC 35	Primary cells and batteries
ISO/TC 79	Light metals and their alloys	IEC TC 113	Nanotechnology for electrotechnical products and systems
ISO/TC 82	Mining	ISO/TC 82	Mining
ISO/TC 82/SC 7	Sustainable mining and mine closure	ISO/TC 82/SC 7	Sustainable mining and mine closure
ISO/TC 155	Nickel and nickel alloys	ISO/TC 82/SC 8	Automated and autonomous mining systems
ISO/TC 334	Reference materials	ISO/TC 298	Rare earth
ISO/TC 345	Materials for specialty technologies	ISO/TC 334	Reference materials
		ISO/TC 345	Materials for specialty technologies

Org. (Cat)	Title
EC (B)	European Commission
ILiA (A)	International Lithium Association

# ISO/TC 333 U.S. Technical Advisory Group

## TAG Stakeholders / Participation

General Interest	Producer Interest	Public Sector/SDOs
Northeastern Univ.	Albemarle	NIST/DOC
CEM Corp.	Arcadium / Rio Tinto	U.S. DOE (NETL, ANL)
Veolia	Mariana Minerals	U.S. EPA
Amphenol-Sensors	Exxon Mobil	MI Geological Survey
Metrohm USA	Chevron	CSA Group
API	Elevated Materials	

# ISO/TC 333 – Lithium – Activity

- **Plenary meeting** – Santa Cruz, Bolivia – November 16 to 18
- Final stage (FDIS)
  - FDIS 10655 – Methods for analysis of lithium hexafluorophosphate — Determination of metal ions content by inductively coupled plasma optical emission spectrometry (ICP-OES)
- Enquiry stage (DIS)
  - DIS 10662 – Determination of main content of lithium carbonate — Potentiometric titration
  - DIS 12380 – Lithium carbonate — Determination of insoluble particles in acid by gravimetry
  - DIS 12386 – Lithium carbonate — Determination of metallic magnetic impurities by ICP-OES
  - DIS 12467-1 – Chemical analysis of lithium composite oxides — Part 1: Determination of main components by inductively coupled plasma optical emission spectrometry
  - DIS 12467-2 – Chemical analysis of lithium composite oxides — Part 2: Determination of trace elemental impurities by inductively coupled plasma optical emission spectrometry
  - DIS 12467-3 – Chemical analysis of lithium composite oxides — Part 3: Determination of lithium carbonate and lithium hydroxide contents
  - DIS 25158 – Guidance for data collection and validation for the calculation of the carbon footprint for Lithium products

# ISO/TC 333 – Lithium – Activity, cont'd





- Committee stage (CD)
  - CD 12403 – Determination of chloride content by potentiometry
- Preparatory stage (WD)
  - WD 24991 – Methods for chemical analysis of lithium concentrates — Determination of lithium oxide content — Flame atomic absorption spectrometry
  - WD 24992 – Methods for analysis of lithium hexafluorophosphate — Determination of anions content by Ion Chromatography (IC)
  - WD 25156 – Cathode active material for lithium-ion battery — Product category rules (PCR)
  - WD 25691 – Methods for chemical analysis of lithium mineral — Determination of Lithium and other elements by ICP-OES
  - WD 25692 – Chemical analysis of lithium composite oxides — Determination of anion contents by ion chromatography
- Preliminary stage (AWI)
  - AWI 11045-1 – Lithium hydroxide - Quantitative determination of lithium hydroxide and carbonate content in lithium hydroxide monohydrate by potentiometric two-step titration
  - AWI 16423 – Lithium hydroxide monohydrate — Determination of elemental impurities by ICP-OES
  - AWI 26496 – Methods for analysis of Lithium Bis(fluorosulfonyl)imide — Determination of Impurity Element content by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)
  - AWI 26497 – Method for analysis of lithium hexafluorophosphate — Determination of free acid content by potentiometric titration
- Ballots (pending):
  - NP 26700 Lithium raw materials for lithium batteries — Carbon footprint of products — Guideline for quantification

# ISO/TC 345 Overview

## Materials for specialty technologies

**Scope:** Standardization in the field of specialty metals, minerals and materials from primary and secondary sources used for specialty technologies (e.g. emerging technologies, renewable energy). It includes: terminology, classification, sampling, testing and chemical analysis methods, traceability, packaging and labelling.

A list of specialty metals and minerals is included as follows: antimony, beryllium, cobalt, chromium, graphite, niobium, platinum group metals, tantalum, vanadium, zirconium.

	ISO/TC 345 - Secretariat
	ISO/TC 345/AHG 1 – Platinum group metals
	ISO/TC 345/AHG 2 – Other metals/minerals, especially Co & Sb
	ISO/TC 345/WG 1 – Test methods for graphite material

**3**

ISO standards under development \*

**15**

Participating members

**17**

Observing members

# ISO/TC 345 Membership

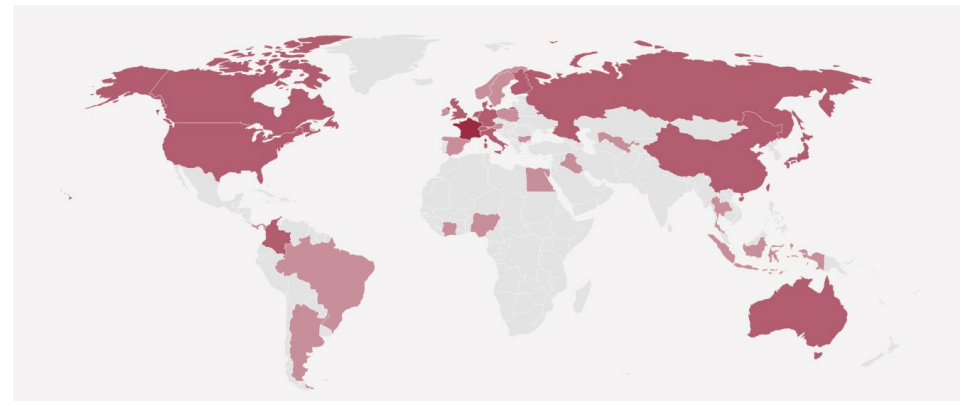
## Participating

Australia	<a href="#">SA</a>
Canada	<a href="#">SCC</a>
China	<a href="#">SAC</a>
Colombia	<a href="#">ICONTEC</a>
Denmark	<a href="#">DS</a>
Finland	<a href="#">SFS</a>
France	<a href="#">AFNOR</a>
Germany	<a href="#">DIN</a>
Italy	<a href="#">UNI</a>
Japan	<a href="#">JISC</a>
Netherlands	<a href="#">NEN</a>
Russian Federation	<a href="#">GOST R</a>
Switzerland	<a href="#">SNV</a>
United Kingdom	<a href="#">BSI</a>
United States	<a href="#">ANSI</a>

## Observers

Argentina	<a href="#">IRAM</a>
Austria	<a href="#">ASI</a>
Brazil	<a href="#">ABNT</a>
Bulgaria	<a href="#">BDS</a>
Côte d'Ivoire	<a href="#">CODINORM</a>
Egypt	<a href="#">EOS</a>
Indonesia	<a href="#">BSN</a>
Iraq	<a href="#">COSQC</a>
Ireland	<a href="#">NSAI</a>

Nigeria	<a href="#">SON</a>
Norway	<a href="#">SN</a>
Panama	<a href="#">DGNTI</a>
Poland	<a href="#">PKN</a>
Spain	<a href="#">UNE</a>
Sweden	<a href="#">SIS</a>
Thailand	<a href="#">TISI</a>
Uzbekistan	<a href="#">O'ZTTSA</a>



# ISO/TC 345 Liaisons

To TC 345	Title	From TC 345	Title
ISO/TC 119	Powder metallurgy	ISO/TC 33	Refractories
ISO/TC 174	Jewellery and precious metals	ISO/TC 69/SC 5	Acceptance sampling
ISO/TC 333	Lithium	ISO/TC 69/SC 6	Measurement methods and results
		ISO/TC 174	Jewellery and precious metals
		ISO/TC 298	Rare earth
		ISO/TC 333	Lithium
		ISO/TC 334	Reference materials

# ISO/TC 345 U.S. Technical Advisory Group

## TAG Stakeholders / Participation

General Interest	Producer Interest	Public Sector/SDOs
MIT	Asbury Carbons	U.S. DOC (NIST, ITA)
IRMA	Novonix	U.S. DOE (NETL, NLR, NREL)
Amphenol-Sensors	WWR	U.S. EPA
Univ. Wyoming		U.S. DOI (BLM, USGS)
		U.S. Trade Rep.
		SAE

# ISO/TC 345 Standards

Standard and/or project under the direct responsibility of ISO/TC 345 Secretariat ↑	Stage	ICS
⦿ <b>ISO/WD 25838</b> [Under development] Test methods for graphite — Determination of graphitization	20.60	
⦿ <b>ISO/WD 25839</b> [Under development] Test methods for graphite — Determination of carbon content	20.60	
⦿ <b>ISO/WD 25840</b> [Under development] Test methods for graphite — Determination of trace metal element content	20.60	

**WD 25838 Abstract** – This document specifies the terms and definitions, principles, test procedures, precision, and test reports of the method for determining the degree of graphitization of graphite materials. This document is applicable for determining the degree of graphitization of graphite materials using X-ray diffraction (XRD).

**WD 25839 Abstract** – The document specifies a test method for analyzing the carbon content of graphite ore and its products. This document applies to natural graphite ore and its products.

**WD 25840 Abstract** – This document specifies the principle, test procedure, precision and test report of the method for the determination of trace metal element content in graphite materials. This document applies to the testing of trace metals (e.g. nickel, cobalt, iron, copper, zinc, manganese and chromium) in graphite materials.

# ISO/TC 345 - Materials for specialty technologies Activity

- **Plenary Meeting** – He Fei Shi (CN) – September 8 to 10
- Previous Resolution
  - Scope broadened to include Ti ores and concentrates (w/ ISO/TC 79/SC 11)
  - May lead to sampling standards
- Previous Ballot:
  - NWIP: "Determination of platinum, palladium, rhodium in Automobile Exhaust-Purifying Catalysts using ICP-AES" – **passed**
  - Similar to standards:
    - HJ 509-2009: Determination of Platinum, Palladium, and Rhodium loading in the vehicle-used ceramic catalytic converters— Inductive Coupled Plasma-Optical Emission Spectrometry and Inductive Coupled Plasma-Mass Spectrometry.
    - GB/T 38744:2020 – Methods for chemical analysis of synergistic elements in automotive exhaust catalysts – Determination of cerium, lanthanum, praseodymium, neodymium, barium and zirconium contents – ICP-AES
    - GB/T 23277:2009 – Chemical analysis methods of catalysts containing precious metals – Determination of platinum, palladium and rhodium in automobile exhaust – purifying catalysts – Spectrophotometry

# THANK YOU

## Contact Information:

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