

# ISO/TS 23359:2025-08 (E)

## Nanotechnologies - Chemical characterization of graphene-related two-dimensional materials from powders and liquid dispersions

---

<b>Contents</b>		<b>Page</b>
Foreword .....		iv
Introduction .....		v
1	Scope .....	1
2	Normative references .....	1
3	Terms and definitions .....	2
4	Abbreviated terms .....	4
5	Approaches to chemical characterization .....	5
6	X-ray photoelectron spectroscopy (XPS) .....	8
6.1	Introduction .....	8
6.2	Instrument preparation .....	8
6.3	Sample preparation .....	8
6.4	Method .....	9
6.5	Quantitative analysis .....	12
7	Thermogravimetric analysis (TGA) .....	13
7.1	Introduction .....	13
7.2	Sample preparation .....	15
7.2.1	General .....	15
7.2.2	Instrument conditions and preparation .....	15
7.2.3	Preparation of crucible .....	15
7.2.4	Measurement procedure .....	15
7.3	Data processing and quantitative analysis .....	16
7.3.1	Data plotting .....	16
7.3.2	Determination of the number of mass change steps .....	16
7.3.3	Determination of the temperature of maximum mass change rate (T <sub>max</sub> ) .....	17
7.3.4	Identification of the GR2M present .....	17
7.3.5	Determine mass percentage .....	17
8	Inductively coupled plasma mass spectrometry (ICP-MS) .....	19
9	Fourier-transform infrared spectroscopy (FTIR) .....	19
10	Reporting .....	19
10.1	Introduction .....	19
10.2	X-ray photoelectron spectroscopy (XPS) .....	20
10.3	Thermogravimetric analysis (TGA) .....	20
10.4	Inductively coupled plasma mass spectrometry (ICP-MS) .....	20
10.5	Fourier-transform infrared spectroscopy (FTIR) .....	20
Annex A (informative)	Inductively coupled plasma mass spectrometry (ICP-MS) .....	21
Annex B (informative)	Fourier-transform infrared spectroscopy (FTIR) .....	26

<b>Annex C (informative) Summary of X-ray photoelectron spectroscopy (XPS) interlaboratory studies .....</b>	<b>29</b>
<b>Annex D (informative) Summary of thermogravimetric analysis (TGA) interlaboratory study .....</b>	<b>34</b>
<b>Annex E (informative) Summary of inductively coupled plasma mass spectrometry (ICP-MS) interlaboratory study .....</b>	<b>41</b>
<b>Annex F (informative) Summary of Fourier-transform infrared spectroscopy (FTIR) mini-interlaboratory study .....</b>	<b>44</b>
<b>Bibliography .....</b>	<b>47</b>