

ISO/TR 23463:2022-05 (E)

Nanotechnologies - Characterization of carbon nanotube and carbon nanofibre aerosols to be used in inhalation toxicity tests

Contents		Page
Foreword		iv
Introduction		v
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Abbreviated terms	8
5	Considerations in CNT and CNF inhalation studies	8
5.1	General	8
5.2	Workplace exposure scenario	8
5.3	Existing inhalation toxicity testing guidelines	9
6	Physicochemical parameters related to the toxicity of CNTs and CNFs	9
6.1	General	9
6.2	Aerodynamic properties of aerosols for deposition of fibres	9
6.3	Size and shape (including length, width, aspect ratio, state of aggregation/ agglomeration, and rigidity)	10
6.4	Specific surface area	11
6.5	Crystalline structure and defects	11
6.6	Surface chemistry, functionalization, surface charge, impurities, and radical generation/scavenging potential	11
6.7	Biodurability	12
7	Issues for the characterization of CNT and CNF aerosols	12
7.1	General	12
7.2	Characterization of physicochemical properties of CNT and CNF prior to aerosol generation	13
7.2.1	General	13
7.2.2	Size and size distribution	13
7.2.3	Shape (rigidity and agglomeration/aggregation)	14
7.2.4	Surface area	14
7.2.5	Crystalline structures	14
7.2.6	Surface chemistry, functionalization, surface charge, and radical generation/scavenging potential	14
7.2.7	Composition, purity, and impurities	14
7.2.8	Biodurability (in vivo and in vitro tests)	15
7.3	CNT and CNF aerosol characterization (sampling and measurement)	15
7.3.1	General	15
7.3.2	Size and size distribution of CNT and CNF aerosols	16
7.3.3	The shape of CNT and CNF aerosols	18
7.3.4	Crystalline structure and defects	18
7.3.5	Surface chemistry	18
7.3.6	Composition analysis	19
7.3.7	Fibre density	19
7.3.8	Concentration	19
7.4	Direct and indirect measurement	20

7.4.1	Direct measurement	20
7.4.2	Indirect measurement	21
Annex A (informative)	Physicochemical properties of CNT associated with biological activity	22
Annex B (informative)	CNT and CNF aerosol monitoring instruments	23
Bibliography		26