
**Space environment (natural
and artificial) — Modelling of
space environment impact on
nanostructured materials — General
principles**

*Environnement spatial (naturel et artificiel) — Modélisation de
l'impact de l'environnement spatial sur les matériaux nanostructurés
— Principes généraux*

(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 22295:2021](https://standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/iso/fa978a14-02a0-4208-9458-9bccea45dc46/iso-ts-22295-2021>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 22295:2021](https://standards.iteh.ai/catalog/standards/iso/fa978a14-02a0-4208-9458-9bccea45dc46/iso-ts-22295-2021)

<https://standards.iteh.ai/catalog/standards/iso/fa978a14-02a0-4208-9458-9bccea45dc46/iso-ts-22295-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions and abbreviated terms	1
3.1 Terms and definitions.....	1
3.2 Abbreviated terms.....	2
4 Nanostructured materials	2
5 Main space environment components and processes	3
5.1 General.....	3
5.2 Space radiation.....	3
5.2.1 General.....	3
5.2.2 Special features of nanostructured materials response.....	3
5.3 Atomic oxygen of the Earth's upper atmosphere.....	4
5.3.1 General.....	4
5.3.2 Special features of nanostructured materials.....	5
5.4 Hot magnetosphere plasma.....	5
5.4.1 General.....	5
5.4.2 Special features of nanostructured materials response.....	5
5.5 Heating, cooling and thermal cycling.....	6
5.5.1 General.....	6
5.5.2 Special features of nanostructured materials.....	6
5.6 Meteoroids and space debris.....	6
5.6.1 General.....	6
5.6.2 Special features of nanostructured materials.....	6
5.7 Solar UV and VUV radiation.....	6
5.7.1 General.....	6
5.7.2 Special features of nanostructured materials.....	7
6 Multiscale approach to simulation of space components impact on nanostructured materials	7
6.1 Multiscale simulation methods.....	7
6.1.1 General.....	7
6.1.2 Quantum (electronic) scale.....	8
6.1.3 Atomistic scale (molecular dynamics and Monte Carlo).....	12
6.1.4 Mesoscale.....	13
6.1.5 Macroscale (continuum methods).....	14
6.2 Radiation damage modelling.....	15
6.2.1 General.....	15
6.2.2 Quantum scale.....	15
6.2.3 Atomistic scale.....	16
6.2.4 Mesoscale.....	16
6.2.5 Macroscale.....	17
6.3 Modelling of atomic oxygen impact.....	17
6.3.1 General.....	17
6.3.2 Quantum scale.....	18
6.3.3 Atomistic scale.....	19
6.3.4 Mesoscale.....	19
6.3.5 Macroscale.....	19
6.4 Modelling of charging effects.....	20
6.4.1 General.....	20
6.4.2 Quantum scale.....	20
6.4.3 Atomistic scale.....	20

6.4.4	Mesoscale	21
6.4.5	Macroscale	21
6.5	Modelling of heating/cooling and thermal cycling effects	21
6.5.1	General	21
6.5.2	Atomistic scale	21
6.5.3	Mesoscale	22
6.5.4	Macroscale	22
6.6	Modelling of meteoroids and space debris impact	22
6.6.1	General	22
6.6.2	Atomistic scale	22
6.6.3	Mesoscale	23
6.6.4	Macroscale	23
6.7	Modelling of solar UV and VUV radiation effects	23
6.7.1	General	23
6.7.2	Quantum scale	23
7	Outlook	23
Annex A (informative) Multiscale simulation methods: software for simulation in different space and time scales		24
Bibliography		27

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 22295:2021](https://standards.iteh.ai/catalog/standards/iso/fa978a14-02a0-4208-9458-9bceea45dc46/iso-ts-22295-2021)

<https://standards.iteh.ai/catalog/standards/iso/fa978a14-02a0-4208-9458-9bceea45dc46/iso-ts-22295-2021>

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

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.

<https://standards.iteh.ai/catalog/standards/iso/fa978a14-02a0-4208-9458-9bceea45dc46/iso-ts-22295-2021>