ISO 17851:2016-09 (E)

Space systems - Space environment simulation for material tests - General principles and criteria

Contents

Page

Foreword v

Introduction vi

1 Scope 1

2 Normative references 1

3 Termsanddefinitions 2
3.1 Terms related to regions in space 2
3.2 Terms related to orbits 2
3.3 Terms related to space environment factors affecting spacecrafts 3
3.4 Terms related to penetration depth of affecting space factors 3
3.5 Terms related to physical and chemical mechanisms of space environment effects on materials 4

4 Abbreviated terms and symbols 4
4.1 Abbreviated terms 4
4.2 Symbols 5

5 Choice of sets of space environment components for typical orbits and regions of space 5
5.1 LEO, including polar (Sun synchronous) orbits 5
5.2 MEO 5
5.3 GSO/GEO 6
5.4 Interplanetary space 6
5.5 Moon 6
5.6 Mars 6
5.7 Jupiter 7
5.8 Mercury 7
5.9 Venus 7

6 General processes for simulation of space environment impact on materials 7
6.1 Processes for simulation 7
6.1.1 LEO including polar orbits 7
6.1.2 MEO 8
6.1.3 GSO/GEO 8
6.1.4 Interplanetary space 8
6.1.5 Near-Moon space and on the Moon surface 8
6.1.6 Near-Mars space and on the Martian surface 9
6.1.7 Near-Jupiter space 9
6.1.8 Near-Mercury and on its surface 9
6.1.9 Near-Venus space and on the Venusian surface 9
6.2 Setting a problem of simulation of space environment on spacecraft materials 9
6.3 Principles of ground-based tests 10
6.4 Requirements to physical and mathematical models 11
6.5 Choice of parameters of laboratory facilities 12

7 General criteria of material resistance to space environment 13
7.1 General regulations on testing materials to space environment 13
7.2 Functional purpose of spacecraft materials 14

7.3 UV tests 14
7.3.1 Degradation mechanism 14
7.3.2 UV sensitive materials 14
7.3.3 Limitations of ground test 14
7.3.4 Typical test apparatus 15
7.3.5 Reference test standards 15
7.4 VUV tests 15
7.4.1 Degradation mechanism 15
7.4.2 VUV sensitive materials 15
7.4.3 Limitations of ground test 15
7.4.4 Typical test apparatus 15
7.4.5 Reference test standards 15
7.5 AO tests 15
7.5.1 Degradation mechanism 15
7.5.2 AO sensitive materials 16
7.5.3 Limitations of ground test 16
7.5.4 Typical test apparatus 16
7.5.5 Reference test standards 16
7.6 Outgassing tests 16
7.6.1 Degradation mechanism 16
7.6.2 Thermal vacuum sensitive materials 17
7.6.3 Limitations of ground test 17
7.6.4 Typical test apparatus 17
7.6.5 Reference test standards 17
7.7 Thermal cycling tests 17
7.7.1 Degradation mechanism 17
7.7.2 Thermal cycling sensitive materials 17
7.7.3 Limitations of ground test 18
7.7.4 Typical test apparatus 18
7.7.5 Reference test standards 18
7.8 Radiation tests 18
7.8.1 Degradation mechanism 18
7.8.2 Radiation sensitive materials 19
7.8.3 Limitations of ground test 19
7.8.4 Typical test apparatus 19
7.8.5 Reference test standards 19
7.9 Micrometeoroid tests 19
7.9.1 Degradation mechanism 19
7.9.2 Hypervelocity impact sensitive materials 19
7.9.3 Limitations of ground test 20
7.9.4 Typical test apparatus 20
7.9.5 Reference test standards 20

8 Recommendations for simulating action of space environment on materials 20

9 Outlook for usage of this International Standard 20

Annex A (informative) Space environment factors, their main parameters and effects 21

Annex B (informative) Mathematical models for research of spacecraft/ environment interaction 23

Bibliography 24