Contents

Protection of Materials and Structures from Space Environment – ICPMSE Proceedings Series: How Did It All Start?	1
Jacob Kleiman	
Analyses of Hubble Space Telescope Aluminized-Teflon Insulation Retrieved After 19 Years of Space Exposure	13
Kim K. de Groh, Deborah L. Waters, Jelila S. Mohammed, Bruce A. Perry, and Bruce A. Banks	
Effect of Solar Exposure on the Atomic Oxygen Erosion of Hubble Space Telescope Aluminized-Teflon Thermal Shields	27
Aobo Guo, Claire C. Ashmead, Kim K. de Groh, and Edward A. Sechkar	
Post-flight Analysis of Materials Exposed on the Spectrometer Sub-unit of MEDET (18 Months On-Board ISS)	41
Virginie Rejsek-Riba, Sabine Soonckindt, Sophie Duzellier, S. Remaury, C. Durin, J.M. Desmarres, A. Tighe, M. Van Eesbeek, C. Lobascio, and M. Nebiolo	
Polymer Strain Experiment on MISSE 6	57
Deborah L. Waters, Kim K. de Groh, Bruce A. Banks, and Edward A. Sechkar	
Passive Space Environment Effect Measurement on JEM/MPAC&SEED	73
Yugo Kimoto, Junichiro Ishizawa, and Hiroyuki Shimamura	
Attenuation of Scattered Thermal Energy Atomic Oxygen	83
Bruce A. Banks, Katelyn T. Seroka, Jason B. McPhate, and Sharon K. Miller	

Optical and Scanning Electron Microscopy of the Materials International Space Station Experiment (MISSE) Spacecraft Silicone Experiment	93
Ching-cheh Hung, Kim K. de Groh, and Bruce A. Banks	
The Effect of Tensile Stress on the Erosion of Polyimide in an Atomic Oxygen Environment	105
Ronen Verker, Dan Hassin, Nurit Atar, and Eitan Grossman	
Critical Evaluation of Testing Results for Russian and Western Space Materials in Ground-Based Simulator Facilities and in Space Experiments	115
Z. Iskanderova, J. Kleiman, V. Issoupov, S.F. Naumov, S.P. Sokolova, A.O. Kurilenok, L.S. Novikov, V.N. Chernik, A.V. Grigorevskiy, and L.V. Kiseleva	
Accelerated Testing of Thermal Control Coatings Using Synchrotron Radiation and Evaluation of Materials Performance	133
H.R. Fischer, Yu. V. Butenko, C. Mooney, C. Semprimoschnig, M.H.W. Verkuijlen, E.R.H. van Eck, and T. Gerber	
Effects of Secondary Electron Emission Yield of Polyimide Films on Atomic Oxygen Irradiation	143
Kumi Nitta, Eiji Miyazaki, Shinichiro Michizono, and Yoshio Saito	
The Effects of MEO Radiation Environment on Triple-Junction GaAs Solar Cells	151
Gao Xin, Yang Sheng-sheng, Wang Yun-fei, and Feng Zhan-zu	
Interaction Mechanism of Soft X-rays with Irradiated Diamond-Like Carbon Films	159
Kazuhiro Kanda, Masahito Niibe, Kumiko Yokota, and Masahito Tagawa	
Degradation of Silicone Oils Exposed to Geostationary Environment Components: Ultraviolet Radiations and Electron Flux	165
H. Jochem, V. Rejsek-Riba, E. Maerten, A. Baceiredo, and S. Remaury	
Complex Investigations of New Black Thermal Control Coatings	177
A.V. Grigorevskiy, L.V. Kiseleva, and V.N. Strapolova	
The Study of Simulated Space Radiation Environment Effect on Conductive Properties of ITO Thermal Control Materials	187
Feng Wei-Quan, Zhao Chun-Qing, Shen Zi-Cai, Ding Yi-Gang, Zhang Fan, Liu Yu-Ming, Zheng Hui-Qi, and Zhao Xue	
Computational Analysis of Mass Loss Rate of Polymeric Composites Under Electron Irradiation in Vacuum	199
R.H. Khasanshin, A.N. Timofeev, and A.N. Galygin	

Effects of Atomic Oxygen and Grease on Outgassing and Adhesion of Silicone Elastomers for Space Applications	209
Henry C. de Groh, Bernadette J. Puleo, and Bruce M. Steinetz	
CNES Experiments on MEDET: Lessons Learned	217
Ch. Durin, S. Remaury, J.C. Mandeville, V. Rejssek-Riba, S. Duzellier, L. Duffours, P. Colombel, T. Woignier, and L. Labat	
Molecular Contamination Analysis on SUZAKU X-ray Imaging Spectrometer	235
Fumitaka Urayama, Atsushi Fujii, Eiji Miyazaki, and Yugo Kimoto	
First Evaluation of Contamination on the JEM/MPAC&SEED	243
Susumu Baba, Junko Matsuyama, Junichiro Ishizawa, and Yugo Kimoto	
A Method of Estimating the Charge Properties of Spacecraft Materials	255
Yifeng Chen, Shengsheng Yang, Xiaogang Qin, and Hong Shi	
Registering the Elemental Composition of Micrometeoroids and Debris	263
N.D. Semkin, A.M. Telegin, and K.E. Voronov	
An Investigation of Stress Dependent Atomic Oxygen Erosion of Black Kapton Observed on MISSE 6	271
Sharon K.R. Miller, Bruce A. Banks, and Edward Sechkar	
The Effect of Surface Cracks on Tensile Strength in Polyimide Films Exposed to Low Earth Orbit in MPAC&SEED Experiment	283
Hiroyuki Shimamura, Yugo Kimoto, and Takashi Nakamura	
Flight Experiment Results of the Polysiloxane-Block-Polyimide “BSF-30” on the JEM/MPAC&SEED Mission on the ISS	295
Eiji Miyazaki, Yugo Kimoto, and Rikio Yokota	
Development of Heat Sealable Polyimide Thin Films with High Space Environmental Stability for Solar Sail IKAROS Membrane	303
Rikio Yokota and Masahiko Miyauchi	
Ion Beam Treatments for Enhancement of Surface Conductivity and Durability of Space Polymers: Results, Analysis, Mechanisms	317
J. Kleiman, Z. Iskanderova, F. Bussieres, A. Grigorevskiy, and R. Sodhi	
Comparison of Properties of Solid Lubricant Between Two Exposure Experiments Aboard the ISS	327
Koji Matsumoto, Mineo Suzuki, and Yugo Kimoto	
Instrumentation for Ground-Based Testing in Simulated Space and Planetary Conditions	337
Jacob Kleiman, Sergey Horodetsky, and Vitali Issoupov	

A Planetary Environmental Simulator/Test Facility	355
Jacob Kleiman, Sergey Horodetsky, and Vitali Issoupov	
Influence of Atomic Oxygen Exposure on Friction Behavior of 321 Stainless Steel	371
Y. Liu, J. Yang, Z. Ye, S. Dong, L. Zhang, and Z. Zhang	
Study of Tensile Properties of Mg-Rare Earth Alloys at Cryogenic Temperatures	381
Hao Wang, Shangli Dong, and Gang Lu	
Embrittlement of MISSE 5 Polymers After 13 Months of Space Exposure	389
Aobo Guo, Grace T. Yi, Claire C. Ashmead, Gianna G. Mitchell, Kim K. de Groh, and Bruce A. Banks	
Temperature Effects of Ultraviolet Irradiation on Material Degradation	399
Kazuyuki Mori and Junichiro Ishizawa	
GEANT4 Simulation of Interplanetary Proton Induced Deep Dielectric Charging	409
Qin Xiaogang, Wang Ji, Yang Shengsheng, Chen Yifeng, and Shi Hong	
Microstructure and Properties of Pure Zirconium After Irradiation by Charged Particles	417
Hai Liu, Hongpeng Zhang, Shangli Dong, Jingdong Xiao, Yong Liu, and Zhengjun Zhang	
Application of Dust Detection Techniques in Space Science and Spacecraft Projects	427
Danming Li, ChengXuan Zhao, Ziyu Ye, Chunyong Wang, Lianjun Jia, and Xing Guo	
Electron Beam Induced Charging and Secondary Electron Emission of Surface Materials	437
Haruhisa Fujii and Yuhki Ishihara	
Observation of Surface Discharge Phenomena on Dielectric Films Under Low Pressure Using Pockels Effect	447
Yohei Komiyama, Shota Suzuki, Hiroaki Miyake, Yasuhiro Tanaka, and Tatsuo Takada	
Charging and Discharging Characteristic on PI Films Irradiated by Protons	459
Ryo Uchiyama, Hiroaki Miyake, Yasuhiro Tanaka, and Tatsuo Takada	
Degradation of Mechanical Properties of Spacecraft Polyimide Film Exposed to Radiation Environments	469
Shen Zicai, Liu Yuming, Feng Weiquan, Zhao Chunqing, and Ding Yigang	

Deposition of Outgassed Products and Products of Radiation-Induced Atomization of Polymeric Composite on Quartz Glass Surfaces	483
R.H. Khasanshin, V.I. Kostyuk, A.N. Galygin, and N.G. Alexandrov	
Contamination of Outer Surfaces of International Space Station Studied by Non-Destructive Techniques	491
V.A. Borisov, S.F. Naumov, S.P. Sokolova, A.O. Kurilenok, V.E. Skurat, A.N. Zhigach, N.G. Beriozkina, I.O. Leipunsky, P.A. Pshechenkov, E.S. Zotova, I.O. Volkov, A.V. Naumkin, and V.V. Artemov	
Passive Measurement of Dust Particles on JEM/MPAC&SEED – Experiment Summary, Particle Fluxes	499
Miyuki Waki and Yugo Kimoto	
Degradation of Optical Elements of Spacecraft Under the Impact of High-Velocity Particles	513
N. Semkin, L. Novikov, and M. Kalaev	
Initial Sticking Rate of O₂ Molecular Beams on Ni (111) Surface Depending on Kinetic Energy	521
Keisuke Inoue and Yuden Teraoka	
Hydrogen Removal from Hydrogenated Diamond-Like Carbon Films by Exposure to Photon and Energetic Atomic Oxygen Beams	531
Kumiko Yokota, Masahito Tagawa, Koji Matsumoto, Yuichi Furuyama, Akira Kitamura, Kazuhiro Kanda, Mayumi Tode, Akitaka Yoshigoe, and Yuden Teraoka	
Resistance of Silicon-Containing Carbonized Lignin to Atomic Oxygen Erosion	541
Takeshi Kajimoto, Toshimitsu Hata, Masahito Tagawa, Hirotsugu Kojima, and Hajime Hayakawa	
Survivability of Silicon-Doped Diamond-Like Carbon Films in Energetic Atomic/Molecular Oxygen Beam Environments	547
Masahito Tagawa, Kazuhiro Kishida, Kumiko Yokota, Koji Matsumoto, Akitaka Yoshigoe, Yuden Teraoka, Jianming Zhang, and Timothy K. Minton	
Measurement of Surface and Volume Resistivity for Silver Coated FEP Used for Spacecraft	557
Hirofumi Suda, Yasushi Yamano, Shinichi Kobayashi, and Kumi Nitta	
Measurement of Quantum Efficiency for Spacecraft Materials and Noise Reduction of Photoelectron Current Waveform	567
Yuta Nanjou, Yasushi Yamano, Shinichi Kobayashi, Kumi Nitta, Hiroaki Miyake, and Kenji Ito	

Microtribological Properties of Molybdenum Disulfide Bonded Film Exposed to Space Environment by SM/SEED Mission	577
Masahito Tagawa, Kumiko Yokota, Kunitaka Ochi, Masao Akiyama, Koji Matsumoto, and Mineo Suzuki	
Extreme Ultraviolet Emission from a Carbon Dioxide Laser-Sustained Oxygen Plasma	587
Akira Mizutani, Kazuhiro Kishida, Kumiko Yokota, Masahito Tagawa, Hiroyuki Shimamura, Yugo Kimoto, Mayuko Koga, and Hiroaki Nishimura	
Measurement of Atomic-Oxygen Flux Distribution	597
Takuya Hisashiba, Kazutaka Kuroda, Hirokazu Masui, Minoru Iwata, Kazuhiro Toyoda, and Mengu Cho	
Author Index	607
Subject Index	611