1. Record Nr. UNINA9911019770803321

Autore	Mittal K. L. <1945->
Titolo	Polymer Surface Modification to Enhance Adhesion : Techniques and Applications
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2024 ©2024
ISBN	9781394231034 1394231032 9781394231027 1394231024
Edizione	[1st ed.]
Descrizione fisica	1 online resource (593 pages)
Altri autori (Persone)	NetravaliAnil Narayan <1948->
Disciplina	668.3
Soggetti	Adhesion Surface chemistry
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Contents -- Preface -- Part I: Energetic Treatments -- Chapter 1 Atmospheric Pressure Plasma Treatment of Polymers to Enhance Adhesion -- 1.1 Introduction -- 1.2 Historical Development of APPTs -- 1.3 Functional Groups Produced by APPTs -- 1.3.1 Nitrogen-Based Surface Modification -- 1.3.2 Oxygen-Based Surface Modification -- 1.4 Adhesion Improvement for Bonding -- 1.4.1 Adhesive Bonding by Functional Groups -- 1.4.2 Adhesive-Free Joining by Functional Coatings -- 1.5 Targeted Adhesion for Biomedical Applications -- 1.6 Relevance of Adhesion in Additive Manufacturing -- 1.6.1 Surface Modification for Adhesion Improvement -- 1.6.2 Enhanced Cell Adhesion and Growth on Additive Manufactured Parts -- 1.7 Summary -- 1.8 Acknowledgements -- References -- Chapter 2 Corona Treatment of Polymer Surfaces to Enhance Adhesion -- 2.1 Introduction -- 2.1.1 Chemical versus Physical Methods in Polymer Surface Modifications -- 2.1.2 Corona Treatment and Impact on Polymers -- 2.1.3 Corona Treatment Applications and Limitations -- 2.2 Mechanism of Corona Treatment -- 2.2.1 Equipment and Operation Details for Corona Treatment -- 2.2.2 Effect of Plasma

Source on Efficiency of Corona Treatment -- 2.3 Factors Affecting Performance of Corona Treatment -- 2.3.1 Effect of Material Surface Preparation: 2-D vs. 3-D -- 2.3.2 Mechanistic Discussions of Corona Parameters -- 2.3.3 Influence of Physical Factors and Equipment Design -- 2.3.4 Influence of Plasma Chemistry and Gas Composition -- 2.3.5 Effects of Process Control Methods -- 2.3.6 Hydrophobic Recovery and Mitigation by Additives -- 2.4 Surface Effects of Corona Treatment -- 2.4.1 Surface Polar Functional Groups -- 2.4.2 Modifying Surface Wettability -- 2.5 Adhesion Improvement by Corona Treatment -- 2.5.1 Polypropylene (PP) -- 2.5.2 Polyethylene (PE).
2.5.3 Poly(ethylene terephthalate) (PET) -- 2.5.4 Poly(vinyl chloride) (PVC) -- 2.5.5 Polystyrene (PS) -- 2.6 Summary -- References -- Chapter 3 Flame Surface Treatment of Polymers to Enhance Their Adhesion -- 3.1 Introduction -- 3.2 Chemistry of Flame Treatment -- 3.3 Flame Treatment Equipment -- 3.4 Factors Controlling Flame Plasma Surface Treatment -- 3.4.1 Flame Chemistry -- 3.4.2 Amount of Plasma Generated -- 3.4.3 Flame Geometry -- 3.4.4 Distance of the Substrate from the Flame -- 3.4.5 Dwell Time -- 3.5 Measurement of Treatment Level -- 3.6 Safety and Other Considerations -- 3.7 Adhesion Improvement -- 3.8 Summary -- References -- Chapter 4 Vacuum UV (VUV) Photo-Oxidation of Polymer Surfaces to Enhance Adhesion -- 4.1 Introduction -- 4.2 Vacuum UV Photo-Oxidation Process -- 4.2.1 VUV Background -- 4.2.2 VUV Radiation -- 4.2.2.1 Emission from Excited Atoms -- 4.2.2.2 Emission from High Pressure Rare Gas Plasmas -- 4.2.2.3 Emission from Rare-Gas Halides and Halogen Dimers -- 4.2.2.4 Other VUV Radiation Sources -- 4.2.3 VUV Optical Filters -- 4.2.4 Penetration Depths of VUV Radiation with Polymers -- 4.2.5 Analytical Methods for Surface Analysis -- 4.2.6 VUV Photochemistry of Oxygen -- 4.2.7 Reactions of O Atoms and Ozone with a Polymer Surface -- 4.3 Adhesion to VUV Surface Photo-Oxidized Polymers -- 4.3.1 Fluorine-Containing Polymers -- 4.3.1.1 Fluoropolymers -- 4.3.1.2 Nafion -- 4.3.2 Polyimides (PIs) -- 4.3.3 Polymers and Metals -- 4.3.4 Polyethylene (PE), -(C2H4)n- -- 4.3.5 Polystyrene (PS) -- 4.3.6 Cyclo-Olefin Polymers -- 4.3.7 Poly(ethylene terephthalate) (PET) -- 4.3.8 Polybenzimidazole (PBI) -- 4.3.9 Poly (etheretherketone) (PEEK) -- 4.3.10 Polypropylene (PP), -(C3H6)n- -- 4.3.11 Poly(ethylene 2,6-naphthalate) (PEN) -- 4.3.12 Polyethersulfone (PES) -- 4.3.13 Polyetherimide (PEI) and Epoxy Resin (RTM6) -- 4.4 Sustainable Polymers.
4.5 Summary -- References -- Chapter 5 Application-Related Optimization of Adhesion of Polymers Using Photochemical Surface Modification -- 5.1 Introduction -- 5.2 Photochemical Surface Modification -- 5.2.1 Fundamentals of the Process -- 5.2.1.1 Photo-Addition or Photo-Grafting -- 5.2.1.2 Layer Formation by Homo-Polymerization and Graft-Co-Polymerization -- 5.2.2 General Process Design -- 5.3 Using Photo-Addition and Photo-Grafting to Promote the Adhesion Property of Hydrophobic Substrates -- 5.4 Enhancing Adhesion of Hydrophobic Materials on Hydrophilic Substrates - Biobased Composites as Case Study -- 5.5 Biosystems: Cell and Protein Adhesion, Antifouling Surfaces -- 5.6 Summary -- Acknowledgement -- References -- Chapter 6 UV/Ozone Surface Treatment of Polymers to Enhance Their Adhesion -- 6.1 Introduction -- 6.1.1 Adhesive Bonding of Polymers -- 6.1.2 UV-C Sensitivity of Polymers -- 6.1.3 UV/Ozone Treatment: Advantages -- 6.1.4 UV/Ozone Treatment: Disadvantages -- 6.2 Historical Development of UV/Ozone Surface Treatment -- 6.3 Parameters Controlling the UV/Ozone Surface Treatment Process -- 6.3.1 Ultraviolet (UV) Light Spectrum -- 6.3.2 UV-Light Generation -- 6.3.3 UV-Light Sources Used -- 6.3.4

Photochemical Ozone Generation -- 6.3.5 Relation between Ozone Generation and UV-Source Power -- 6.3.6 Temperature during UV/Ozone Treatment on Polyolefin Surfaces -- 6.3.7 Influence of Wavelength(s) and Gas Fill on Polyolefin Surfaces -- 6.3.8 Influence of Ozone Gas and UV-Light Spectrum on Polymer Surface Wetting -- 6.3.9 Main Process Variables: Overview -- 6.4 Surface Changes of Polymeric Materials by UV/Ozone Treatment -- 6.4.1 Polymer Bonds -- 6.4.2 Surface Cleaning by UV/Ozone: Increasing Hydrophilicity and Surface Free Energy -- 6.4.3 Photo-Degradation: Surface Roughness and Morphology Changes -- 6.4.4 UV-Light Treatment Depth in Polymer Surfaces.
6.4.5 Surface Relaxation of HDPE -- 6.5 Surface Analysis of UV/Ozone Treated Polymeric Surfaces -- 6.5.1 Scanning Electron Microscopy (SEM) on UV/Ozone Treated Carbon Fibre Reinforced Polymer (CFRP) -- 6.5.2 Atomic Force Microscopy (AFM) on UV/Ozone Treated CFRP -- 6.5.3 X-Ray Photoelectron Spectroscopy (XPS) on UV/Ozone Treated CFRP -- 6.5.4 Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR) Investigation on UV/Ozone Treated CFRP -- 6.5.5 Optically Stimulated Electron Emission (OSEE) Investigation on UV/Ozone Treated CFRP -- 6.5.6 Contact Angle Measurements on UV/Ozone Treated CFRP -- 6.6 UV/Ozone Treatment of Polymers: Improved Wetting and Adhesion -- 6.6.1 Introduction: UV/Ozone Treatment of Polymers -- 6.6.2 UV/Ozone Treatment of Thermoset Materials -- 6.6.2.1 Introduction: UV/Ozone Treatment of CFRP -- 6.6.2.2 Mechanical Tests on UV/Ozone Treated CFRP -- 6.6.2.3 Mechanical Fatigue Loading of UV/Ozone Treated CFRP -- 6.6.2.4 Adhesive Bonding of UV/Ozone Treated CFRP to Aluminium -- 6.6.2.5 UV/Ozone Treatment and Testing of Aerospace Primers -- 6.6.2.6 Mechanical Tests on UV/Ozone Treated Epoxy Coated Magnets -- 6.6.2.7 UV/Ozone Modification of Poly(dimethylsiloxane) -- 6.6.3 UV/Ozone Treatment of Thermoplastics -- 6.6.3.1 Adhesive Bonding of POM to Aluminium -- 6.6.3.2 Adhesive Bonding of Polyethylene (PE) to Stainless Steel -- 6.6.3.3 Adhesive Bonding and Aging of HDPE -- 6.6.3.4 Adhesive Bonding of Polyethylene (PE) to Acrylonitrile Styrene Acrylate (ASA) -- 6.6.3.5 Adhesive Bonding of Polypropylene (PP) -- 6.6.3.6 Surface Treatment of Nylon (Polyamide 6) -- 6.6.3.7 UV/Ozone Treatment of Poly(phenylene sulphide) (PPS) -- 6.6.3.8 UV/Ozone Treatment of Poly(methyl methacrylate) (PMMA) -- 6.6.3.9 Adhesive Bonding of Flexible Polymeric Solar Cells -- 6.6.3.10 Treatment of ABS for Adhesive Bonding.
6.6.3.11 Adhesive Bonding of Styrene-Acrylonitrile (SAN) to a Thermoplastic Elastomer (TPE) -- 6.6.4 UV/Ozone Treatment of Rubbers -- 6.6.4.1 UV/Ozone Treatment of SBS Rubber -- 6.6.4.2 Surface Treatment of Ethylene Propylene Diene Monomer (EPDM) Rubber to Optimize the Adhesion of a Coating -- 6.6.4.3 EPDM Rubber Pre-Treated by a Low Pressure UV-Source -- 6.7 Prospects -- 6.8 Summary -- Acknowledgements -- References -- Chapter 7 Adhesion Enhancement of Polymer Surfaces by Ion Beam Treatment -- 7.1 Introduction -- 7.1.1 Ion Beam - Surface Interactions: Background -- 7.1.2 Ion Beam - Surface Interactions: Kinetics -- 7.1.3 Computer Simulations of Ion Beam - Solid Interactions -- 7.2 Ion Beam Treatment of Polymers -- 7.2.1 Principle of Technique -- 7.2.2 Types of Ion Beams and Interactions -- 7.2.3 Impacts and Outcome of Polymer Surface Modification -- 7.3 Analysis Techniques to Analyze Post Ion Beam Treatment -- 7.3.1 X-Ray Diffraction -- 7.3.2 Scanning Electron Microscopy (SEM) -- 7.3.3 Scanning Tunneling Microscopy (STM) -- 7.3.4 Fourier Transform Infrared Spectroscopy -- 7.3.5 Raman Spectroscopy -- 7.3.6 UV Spectroscopy -- 7.3.7 X-Ray Photoelectron

Spectroscopy (XPS) -- 7.3.8 Atomic Force Microscopy (AFM) -- 7.3.9 Wettability Measurements -- 7.4 Polymer Surface Modifications for Biomedical Applications -- 7.4.1 Poly(lactic acid) (PLA) -- 7.4.2 Poly(L-lactic acid) (PLLA) -- 7.4.3 Poly(L-lactide) (PLA), Poly(D, L-Lactide-co-glycolide) (PDLG) and Poly(L-lactide-co-caprolactone) (PLC) -- 7.4.4 Poly(dimethylsiloxane) (PDMS) -- 7.4.5 He+ Ion Irradiation of Selected Polymeric Materials -- 7.4.6 Ion Beam Assisted Deposition (IBAD) -- 7.4.7 Ion Beam Texturing (IBT) -- 7.5 Polymer Surface Modification for Microelectronics Applications -- 7.5.1 Bisphenol A Polycarbonate (PC) -- 7.5.2 Aluminum Films on Bisphenol A Polycarbonate (PC). 7.5.3 Indium Tin Oxide (ITO) Films on Bisphenol A Polycarbonate (PC).

Sommario/riassunto

This book explores the various techniques and applications of polymer surface modification to enhance adhesion. It delves into fundamental and theoretical aspects of adhesion, including modeling phenomena, mechanisms, and surface analysis. The text covers practical methods such as atmospheric pressure plasma treatment, corona treatment, flame surface treatment, and vacuum UV treatments, among others. These methods are examined for their impact on adhesion in different contexts, including biomedical applications and additive manufacturing. The book aims to provide insights into the improvement of bonding and durability of adhesive joints, with a focus on both traditional and innovative approaches. It is intended for professionals and researchers in the fields of materials science, engineering, and chemistry.