

1. Record Nr.	UNINA9910841218203321
Autore	O'Hanlon John F
Titolo	A Users Guide to Vacuum Technology
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2023 ©2024
ISBN	1-394-17423-3 1-394-17414-4
Edizione	[4th ed.]
Descrizione fisica	1 online resource (579 pages)
Altri autori (Persone)	GessertTimothy A
Disciplina	621.5/5
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Dedication Page -- Contents -- Preface -- Symbols -- Part I Its Basis -- Chapter 1 Vacuum Technology -- 1.1 Units of Measurement -- References -- Chapter 2 Gas Properties -- 2.1 Kinetic Picture of a Gas -- 2.1.1 Velocity Distribution -- 2.1.2 Energy Distribution -- 2.1.3 Mean Free Path -- 2.1.4 Particle Flux -- 2.1.5 Monolayer Formation Time -- 2.1.6 Pressure -- 2.2 Gas Laws -- 2.2.1 Boyle's Law -- 2.2.2 Amontons' Law -- 2.2.3 Charles' Law -- 2.2.4 Dalton's Law -- 2.2.5 Avogadro's Law -- 2.2.6 Graham's Law -- 2.3 Elementary Gas Transport Phenomena -- 2.3.1 Viscosity -- 2.3.2 Thermal Conductivity -- 2.3.3 Diffusion -- 2.3.4 Thermal Transpiration -- References -- Chapter 3 Gas Flow -- 3.1 Flow Regimes -- 3.2 Flow Concepts -- 3.3 Continuum Flow -- 3.3.1 Orifice -- 3.3.2 Long Round Tube -- 3.3.3 Short Round Tube -- 3.4 Molecular Flow -- 3.4.1 Orifice -- 3.4.2 Long Round Tube -- 3.4.3 Short Round Tube -- 3.4.4 Irregular Structures -- 3.4.5 Components in Parallel and Series -- 3.5 Models Spanning Molecular and Viscous Flow -- References -- Chapter 4 Gas Release from Solids -- 4.1 Vaporization -- 4.2 Diffusion -- 4.2.1 Reduction of Outdiffusion by Vacuum Baking -- 4.3 Thermal Desorption -- 4.3.1 Zero Order -- 4.3.2 First Order -- 4.3.3 Second Order -- 4.3.4 Desorption from Real Surfaces -- 4.3.5 Outgassing Measurements -- 4.3.6 Outgassing Models -- 4.3.7 Reduction by Baking -- 4.4 Stimulated Desorption --

4.4.1 Electron-Stimulated Desorption -- 4.4.2 Ion-Stimulated Desorption -- 4.4.3 Stimulated Chemical Reactions -- 4.4.4 Photo Desorption -- 4.5 Permeation -- 4.5.1 Atomic and Molecular Permeation -- 4.5.2 Dissociative Permeation -- 4.5.3 Permeation and Outgassing Units -- 4.6 Pressure Limitations During Pumping -- References -- Part II Measurement -- Chapter 5 Pressure Gauges -- 5.1 Direct Reading Gauges.  
5.1.1 Diaphragm and Bourdon Gauges -- 5.1.2 Capacitance Manometer -- 5.2 Indirect Reading Gauges -- 5.2.1 Thermal Conductivity Gauges -- 5.2.2 Spinning Rotor Gauge -- 5.2.3 Ionization Gauges -- References -- Chapter 6 Flow Meters -- 6.1 Molar Flow, Mass Flow, and Throughput -- 6.2 Rotameters and Chokes -- 6.3 Differential Pressure Devices -- 6.4 Thermal Mass Flow Technique -- 6.4.1 Mass Flow Meter -- 6.4.2 Mass Flow Controller -- 6.4.3 Mass Flow Meter Calibration -- References -- Chapter 7 Pumping Speed -- 7.1 Definition -- 7.2 Mechanical Pump Speed Measurements -- 7.3 High Vacuum Pump Speed Measurements -- 7.3.1 Methods -- 7.3.2 Gas and Pump Dependence -- 7.3.3 Approximate Speed Measurements -- 7.3.4 Errors -- References -- Chapter 8 Residual Gas Analyzers -- 8.1 Instrument Description -- 8.1.1 Ion Sources -- 8.1.2 Mass Filters -- 8.1.3 Detectors -- 8.2 Installation and Operation -- 8.2.1 Operation at High Vacuum -- 8.2.2 Operation at Medium and Low Vacuum -- 8.3 Calibration -- 8.4 Choosing an Instrument -- References -- Chapter 9 Interpretation of RGA Data -- 9.1 Cracking Patterns -- 9.1.1 Dissociative Ionization -- 9.1.2 Isotopes -- 9.1.3 Multiple Ionization -- 9.1.4 Combined Effects -- 9.1.5 Ion-Molecule Reactions -- 9.2 Qualitative Analysis -- 9.3 Quantitative Analysis -- 9.3.1 Isolated Spectra -- 9.3.2 Overlapping Spectra -- References -- Part III Production -- Chapter 10 Mechanical Pumps -- 10.1 Rotary Vane -- 10.2 Lobe -- 10.3 Claw -- 10.4 Multistage Lobe -- 10.5 Scroll -- 10.6 Screw -- 10.7 Diaphragm -- 10.8 Reciprocating Piston -- 10.9 Mechanical Pump Operation -- References -- Chapter 11 Turbomolecular Pumps -- 11.1 Pumping Mechanism -- 11.2 Speed-Compression Relations -- 11.2.1 Maximum Compression -- 11.2.2 Maximum Speed -- 11.2.3 General Relation -- 11.3 Ultimate Pressure -- 11.4 Turbomolecular Pump Designs -- 11.5 Turbo-Drag Pumps. References -- Chapter 12 Diffusion Pumps -- 12.1 Pumping Mechanism -- 12.2 Speed-Throughput Characteristics -- 12.3 Boiler Heating Effects -- 12.4 Backstreaming, Baffles, and Traps -- References -- Chapter 13 Getter and Ion Pumps -- 13.1 Getter Pumps -- 13.1.1 Titanium Sublimation -- 13.1.2 Non-evaporable Getters -- 13.2 Ion Pumps -- References -- Chapter 14 Cryogenic Pumps -- 14.1 Pumping Mechanisms -- 14.2 Speed, Pressure, and Saturation -- 14.3 Cooling Methods -- 14.4 Cryopump Characteristics -- 14.4.1 Sorption Pumps -- 14.4.2 Gas Refrigerator Pumps -- 14.4.3 Liquid Cryogen Pumps -- References -- Part IV Materials -- Chapter 15 Materials in Vacuum -- 15.1 Metals -- 15.1.1 Vaporization -- 15.1.2 Permeability -- 15.1.3 Outgassing -- 15.1.4 Structural Metals -- 15.2 Glasses and Ceramics -- 15.3 Polymers -- References -- Chapter 16 Joints Seals and Valves -- 16.1 Permanent Joints -- 16.1.1 Welding -- 16.1.2 Soldering and Brazing -- 16.1.3 Joining Glasses and Ceramics -- 16.2 Demountable Joints -- 16.2.1 Elastomer Seals -- 16.2.2 Metal Gaskets -- 16.3 Valves and Motion Feedthroughs -- 16.3.1 Small Valves -- 16.3.2 Large Valves -- 16.3.3 Special-Purpose Valves -- 16.3.4 Motion Feedthroughs -- References -- Chapter 17 Pump Fluids and Lubricants -- 17.1 Pump Fluids -- 17.1.1 Fluid Properties -- 17.1.2 Fluid Types -- 17.1.3 Selecting Fluids -- 17.1.4 Reclamation -- 17.2 Lubricants -- 17.2.1 Lubricant Properties -- 17.2.2 Selecting Lubricants --

References -- Part V Systems -- Chapter 18 Rough Vacuum Pumping  
-- 18.1 Exhaust Rate -- 18.1.1 Pump Size -- 18.1.2 Aerosol Formation  
-- 18.2 Crossover -- 18.2.1 Minimum Crossover Pressure -- 18.2.2  
Maximum Crossover Pressure -- References -- Chapter 19 High  
Vacuum Systems -- 19.1 Diffusion-Pumped Systems -- 19.1.1  
Operating Modes -- 19.1.2 Operating Issues -- 19.2 Turbo-Pumped  
Systems -- 19.2.1 Operating Modes.  
19.2.2 Operating Issues -- 19.3 Sputter-Ion-Pumped Systems --  
19.3.1 Operating Modes -- 19.3.2 Operating Issues -- 19.4 Cryo-  
Pumped Systems -- 19.4.1 Operating Modes -- 19.4.2 Regeneration --  
19.4.3 Operating Issues -- 19.5 High Vacuum Chambers -- 19.5.1  
Managing Water Vapor -- References -- Chapter 20 Ultraclean Vacuum  
Systems -- 20.1 Ultraclean Pumps -- 20.1.1 Dry Roughing Pumps --  
20.1.2 Turbopumps -- 20.1.3 Cryopumps -- 20.1.4 Sputter-Ion, TSP,  
and NEG Pumps -- 20.2 Ultraclean Chamber Materials and Components  
-- 20.3 Ultraclean System Pumping and Pressure Measurement --  
References -- Chapter 21 Controlling Contamination in Vacuum  
Systems -- 21.1 Defining Contamination in a Vacuum Environment --  
21.1.1 Establishing Control of Vacuum Contamination -- 21.1.2 Types  
of Vacuum Contamination -- 21.2 Pump Contamination -- 21.2.1  
Low/Rough and Medium Vacuum Pump Contamination -- 21.2.2 High  
and UHV Vacuum Pump Contamination -- 21.3 Evacuation  
Contamination -- 21.3.1 Particle Sources -- 21.3.2 Remediation  
Methods -- 21.4 Venting Contamination -- 21.5 Internal Components,  
Mechanisms, and Bearings -- 21.6 Machining Contamination -- 21.6.1  
Cutting, Milling, and Turning -- 21.6.2 Grinding and Polishing --  
21.6.3 Welding -- 21.7 Process-Related Sources -- 21.7.1 Deposition  
Sources -- 21.7.2 Leak Detection -- 21.8 Lubrication Contamination --  
21.8.1 Liquid Lubricants -- 21.8.2 Solid Lubricants -- 21.8.3 Lamellar,  
Polymer, and Suspension Lubricants -- 21.9 Vacuum System  
and Component Cleaning -- 21.9.1 Designing a Cleaning Process --  
21.10 Review of Clean Room Environments for Vacuum Systems --  
21.10.1 The Cleanroom Environment -- 21.10.2 Using Vacuum  
Systems in a Cleanroom Environment -- References -- Chapter 22 High  
Flow Systems -- 22.1 Mechanically Pumped Systems -- 22.2 Throttled  
High Vacuum Systems -- 22.2.1 Chamber Designs -- 22.2.2 Turbo  
Pumped.  
22.2.3 Cryo Pumped -- References -- Chapter 23 Multichambered  
Systems -- 23.1 Flexible Substrates -- 23.2 Rigid Substrates -- 23.2.1  
Inline Systems -- 23.2.2 Cluster Systems -- 23.3 Analytical  
Instruments -- References -- Chapter 24 Leak Detection -- 24.1 Mass  
Spectrometer Leak Detectors -- 24.1.1 Forward Flow -- 24.1.2 Counter  
flow -- 24.2 Performance -- 24.2.1 Sensitivity -- 24.2.2 Response  
Time -- 24.2.3 Testing Pressurized Chambers -- 24.2.4 Calibration --  
24.3 Leak Hunting Techniques -- 24.4 Leak Detecting with Hydrogen  
Tracer Gas -- References -- Part VI Appendices -- Appendix A Units  
and Constants -- A.1 Physical Constants -- A.2 SI Base Units -- A.3  
Conversion Factors -- Appendix B Gas Properties -- B.1 Mean Free  
Paths of Gasses as a Function of Pressure at T = 25°C -- B.2 Physical  
Properties of Gasses and Vapors at T = 0°C -- B.3 Cryogenic Properties  
of Gases -- B.4 Gas Conductance and Flow Formulas -- B.5 Vapor  
Pressure Curves of Common Gases -- B.6 Appearance of Discharges in  
Gases and Vapors at Low Pressures -- B.7 DC Breakdown Voltages for  
Air and Helium Between Flat Parallel Plates -- B.8 Particle Settling  
Velocities in Air -- Appendix C Material Properties -- C.1 Outgassing  
Rates of Vacuum-Baked Metals -- C.2 Outgassing Rates of Unbaked  
Metals -- C.3 Outgassing Rates of Ceramics and Glasses -- C.4  
Outgassing Rates of Elastomers -- C.5 Permeability of Polymeric

Materials -- C.6 Vapor Pressure Curves of the Solid and Liquid Elements (Sheet A) -- C.7 Outgassing Rates of Polymers -- C.8 Austenitic Stainless Steels -- Appendix D Isotopes -- D.1 Natural Abundances -- Appendix E Cracking Patterns -- E.1 Cracking Patterns of Pump Fluids -- E.2 Cracking Patterns of Gases -- E.3 Cracking Patterns of Common Vapors -- E.4 Cracking Patterns of Common Solvents -- E.5 Cracking Patterns of Semiconductor Dopants -- Appendix F Pump Fluid Properties.  
F.1 Compatibility of Elastomers and Pump Fluids.

---