

1. Record Nr.	UNINA9910789065803321
Titolo	Spectroscopy, dynamics and molecular theory of carbon plasmas and vapors [[electronic resource]] : advances in the understanding of the most complex high-temperature elemental system / / editors, Laszlo Nemes, Stephan Irle ; foreword by Harold Kroto
Pubbl/distr/stampa	Singapore ; ; London, : World Scientific, 2011
ISBN	1-283-43328-1 9786613433282 981-283-765-5
Descrizione fisica	1 online resource (536 p.)
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Disciplina	530.443 541.28
Soggetti	Plasma (ionized gases) Nanostructured materials Vapors Carbon Quantum theory Molecular spectroscopy Atomic spectroscopy
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Foreword; Preface; Contents; Experimental; Chapter 1 Spectroscopy of Carbon Nanotube Production Processes; 1. Introduction; 2. Arc Discharge; 3. Laser Plumes; 4. Glow Discharge; 5. Flames; 6. Conclusions; References; Chapter 2 Spectroscopic Studies on Laser-Produced Carbon Vapor; 1. Introduction; 2. Experimental Apparatus; 2.1. Laser ablation system; 2.2. Optical emission spectroscopy; 2.3. Laser-induced fluorescence imaging spectroscopy; 3. Optical Emission from Laser-Produced Carbon Vapor [Sasaki et al. (2002)]; 3.1. Temporal variation of optical emission intensity

3.2. Optical emission spectrum 3.3. Spatial distribution of delayed continuum emission; 4. Spatiotemporal Variations of C2 and C3 Radical Densities [Sasaki et al. (2002)]; 4.1. C2 and C3 radical densities in vacuum; 4.2. C2 and C3 radical densities in ambient He gas at 1 Torr; 4.3. C2 and C3 radical densities in ambient He gas at 5 Torr; 5. Temporal Change in the Total Numbers of C2 and C3; 6. Spatiotemporal Variation of Plume Temperature [Sasaki and Aoki (2008)]; 6.1. Evaluation of plume temperature; 6.2. Spatial distribution of plume temperature; 6.3. Temporal variation of plume temperature 7. A Scenario for the Growth of Carbon Clusters 8. Conclusions; References; Chapter 3 Kinetic and Diagnostic Studies of Carbon Containing Plasmas and Vapors Using Laser Absorption Techniques; 1. Introduction; 2. Plasma Chemistry and Reaction Kinetics; 2.1. General considerations; 2.2. Molecular microwave plasmas containing hydrocarbons; 3. Gas-Phase Characterization in Diamond Hot-Filament CVD; 4. Kinetic Studies and Molecular Spectroscopy of Radicals; 4.1. Line strengths and transition dipole moment of CH₃; 4.2. Molecular spectroscopy of the CN radical 5. Quantum Cascade Laser Absorption Spectroscopy for Plasmas Diagnostics and Control 5.1. General considerations; 5.2. Trace gas measurements using optically resonant cavities; 5.3. In situ monitoring of plasma etch processes with a QCL arrangement in semiconductor industrial environment; 6. Summary and Conclusions; Acknowledgements; References; Chapter 4 Spectroscopy of Carbon Containing Diatomic Molecules; 1. Introduction; 1.1. Differences between atomic and diatomic spectra; 1.2. The line strength; 2. Diatomic Quantum Theory; 2.1. Diatomic eigenfunctions; 2.2. Diatomic parity 2.3. Homonuclear diatomics 2.4. Born-Oppenheimer approximation; 2.5. Hund's angular momentum coupling cases; 3. The Diatomic Hamiltonian; 3.1. The rotational Hamiltonian; 3.2. The fine structure Hamiltonian; 3.3. Hamiltonian matrix elements in Hund's case (a); 3.4. Centrifugal corrections to molecular parameters; 4. Finding the Molecular Parameters by Fitting a Measured Spectrum; 4.1. Example of a spectrum fit; 5. Diatomic Line Strengths in the Case (a) Basis; 5.1. RKR potentials and vibrational eigenfunctions; 5.2. Computation of the diatomic line strength 6. Example Applications of Line Strengths

Sommario/riassunto

This book is a stop-gap contribution to the science and technology of carbon plasmas and carbon vapors. It strives to cover two strongly related fields: the molecular quantum theory of carbon plasmas and carbon nanostructures; and the molecular and atomic spectroscopy of such plasmas and vapors. These two fields of research are strongly intertwined and thus reinforce one another. Even though the use of carbon nanostructures is increasing by the day and their practical uses are emerging, there is no modern review on carbon plasmas, especially from molecular theoretical and spectroscopic viewpoints