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Nota di contenuto	Graphene; Contents; Preface; List of Contributors; 1 Synthesis, Characterization, and Selected Properties of Graphene; 1.1 Introduction; 1.2 Synthesis of Single-Layer and Few-Layered Graphenes; 1.2.1 Mechanical Exfoliation; 1.2.2 Chemical Exfoliation; 1.2.3 Chemical Vapor Deposition; 1.2.4 Arc Discharge; 1.2.5 Reduction of Graphite Oxide; 1.3 Synthesis of Graphene Nanoribbons; 1.4 Selected Properties; 1.4.1 Magnetic Properties; 1.4.2 Electrical Properties; 1.4.2.1 Supercapacitors; 1.4.2.2 Photovoltaics and Photodetectors; 1.4.2.3 Field Emission and Blue Light Emission 1.4.3 Molecular Charge Transfer1.4.4 Decoration with Metal and Oxide Nanoparticles; 1.4.5 Surface Area and Gas Adsorption; 1.4.6 Mechanical Properties; 1.4.7 Quenching of Fluorescence of Aromatics; 1.4.8 Chemical Storage of Hydrogen and Halogens; 1.5 Inorganic Graphene Analogs; References; 2 Understanding Graphene via Raman Scattering; 2.1 Introduction; 2.2 Atomic Structure and Electronic Structure of Graphene; 2.3 Phonons and Raman Modes in Graphene; 2.4 Layer Dependence of Raman Spectra; 2.4.1 G-Band; 2.4.2 2D-Band; 2.4.3 D-Band; 2.4.4 Combination Modes in the Range 1650-2300 cm <sup>-1</sup>

2.4.5 Low-Frequency Modes; 2.5 Phonon Renormalization Due to Electron and Hole Doping of Graphene; 2.5.1 Optical Phonon Mixing in Doped Bi- and Multilayer Graphene; 2.5.2 Charge Inhomogeneity and p-n Junction in the FET Channel Probed by Raman Spectroscopy; 2.6 Raman Spectroscopy of Graphene Edges and Graphene Nanoribbons; 2.6.1 Effect of the Edge Orientation on the G-Band; 2.6.2 Effect of the Edge Orientation on the D-Band; 2.6.3 Raman Spectroscopy of Graphene Nanoribbons; 2.7 Effect of Disorder on the Raman Spectrum of Graphene; 2.8 Raman Spectroscopy of Graphene under Strain; 2.9 Temperature and Pressure Dependence of Raman Modes in Graphene as Nanometrological Tools; 2.10 Tip-Enhanced Raman Spectroscopy of Graphene Layers; 2.11 Conclusions; Acknowledgments; References; 3 Physics of Quanta and Quantum Fields in Graphene; 3.1 Introduction; 3.2 Dirac Theory in 3 + 1 Dimensions: A Review; 3.3 Band Structure of Graphene: Massless Chiral Dirac Electrons in 2 + 1 Dimensions; 3.3.1 Phase Vortices of Bloch States in k-Space; 3.4 Anomaly - A Brief Introduction; 3.4.1 Anomalous Commutator in (1 + 1) Dimensions; 3.4.2 Axial Anomaly in (1 + 1), (3 + 1) Dimensions; 3.5 Graphene and 2 + 1-Dimensional Parity Anomaly; 3.6 Zitterbewegung; 3.7 Klein Paradox; 3.8 Relativistic-Type Effects and Vacuum Collapse in Graphene in Crossed Electric and Magnetic Fields; 3.9 Prediction of Spin-1 Quanta from Resonating Valence Bond Correlations; 3.10 Majorana Zero Mode from Two-Channel Kondo Effect in Graphene; 3.11 Lattice Deformation as Gauge Fields; 3.12 Summary; Acknowledgment; References; 4 Magnetism of Nanographene; 4.1 Introduction; 4.2 Theoretical Background of Magnetism in Nanographene and Graphene Edges; 4.3 Experimental Approach to Magnetism of Nanographene; 4.3.1 Magnetic Structure of Edge-State Spins in Nanographene

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## Sommario/riassunto

The only balanced overview available, focusing on all areas of scientific interest surrounding this fascinating molecule. In one handy volume it offers comprehensive coverage of the topic, including chemistry, materials science, nanoscience, physics, engineering, life science, and potential applications. Edited by a famous and well-respected scientist, who is also a brilliant teacher, this is an invaluable companion for inorganic, organic, and physical chemists, materials scientists, and physicists.

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