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5.3 Microscale Fabrication: Contact Photolithography; 5.3.1 Principle of Photolithography; 5.3.2 Physical Limit of Contact Photolithography; 5.3.3 Perfect Contact Utilizing Newton's Interference Rings; 5.3.4 Additive and Subtractive Lithographic Pattern Transfer; 5.3.5 Alignment Structures; 5.3.6 Controlling the Undercut during Development; 5.3.7 Critical Dimensions & Resist Profile ; 5.4 Nanoscale Fabrication: Electron-Beam Lithography
5.4.1 The Electron-Matter Interaction5.4.2 Discrete Beam-Deflection, Exposure Dose and Dynamic Effects; 5.4.3 Alignment of the Stage Relative to the Beam; 5.4.4 Clearing-Dose Determination (PMMA950 k); 5.4.5 PMMA950 k to Obtain a Lift-Off Profile: Critical Dimension 10nm; 5.4.6 Proximity Effect Model(s); 5.4.7 Simulated Proximity-Effect Correction; 5.4.8 Manufacturing in the Sub - 100nm RegimeWithout Correction for the Proximity Effect; 5.4.9 ZEP 520A Etch Protection Layer: Critical Dimension 60nm; 5.5 Symbiotic Optimization of the Nanolithography and RF-Plasma Etching
5.6 Reactive Ion Etching5.6.1 Proper Operation of the Radio-Frequency Discharge; 5.6.2 Etching Rate Determination; 5.6.3 Etched Photolithographic Critical Dimensions; 5.7 The 50nm Scale Compared to the Bit-Pattern on a Compact-Disk; Appendix 5.1: Phenomenological Electron-Beam Proximity Effect; Appendix 5.2: CASINO: Monte Carlo Simulation of the Electron-Matter Interaction; References; Chapter 6 Device Manufacturing; 6.1 Fabrication Process Chains; 6.2 Postfabrication Procedures: Sawing & Wire Bonding; 6.3 Manufacturing Twenty Devices in One Run: Small Scale Production; References Chapter 7 Proof of Principle of the Above Described Approach

Sommario/riassunto

Holger Bartolf discusses state-of-the-art detection concepts based on superconducting nanotechnology as well as sophisticated analytical formulæ that model dissipative fluctuation-phenomena in superconducting nanowire single-photon detectors. Such knowledge is desirable for the development of advanced devices which are designed to possess an intrinsic robustness against vortex-fluctuations and it provides the perspective for honorable fundamental science in condensed matter physics. Especially the nanowire detector allows for ultra-low noise detection of signals with single-photon sensitivity and GHz repetition rates. Such devices have a huge potential for future technological impact and might enable unique applications (e.g. high rate interplanetary deep-space data links from Mars to Earth). Contents Superconducting Single-Photon Detectors Nanotechnological Manufacturing; Scale: 10 Nanometer Berezinskii-Kosterlitz Thouless (BKT) Transition, Edge-Barrier, Phase Slips Target Groups Researchers and students of physics in the fields of single-photon devices, nanofabrication, nanophotonics, nanoelectronics and superconductivity Industrial practitioners with focus on nanotechnology and single-photon detectors About the Author Holger Bartolf studied Solid State Physics at the Universities of Karlsruhe and Zürich. In 2011 he relocated at the Swiss Corporate Research Center of a leading company in power and automation technologies where his current interests focus on the applied R&D of the next generation of power semiconductors.
