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Title:Fast neutron irradiation of high-T"c superconducting materials engineered for magnetic field and THz photon detection
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Abstract:Radiation-hard sensors are at present time highly requested for applications in environments with potential radiation hazard such as space, accelerators and fusion machines. We developed device prototypes for magnetic field and THz photon detection, both based on $YBa_2Cu_3O_{7-x}$ (YBCO) superconducting films locally nanostructured by means of 0.25GeV Au-ion lithography. This micro-collimated implantation of high-density columnar defects in YBCO films allows localizing external electromagnetic excitations by means of dissipative signals only induced into the nanostructured regions. The radiation hardness of detector prototypes was checked under fast neutron radiation. It turns out that, up to a neutron fluence comparable with those expected for 10years long permanence in the space, no significant change was detected in superconductor characteristics such as zero-field resistance-temperature or magneto-resistance, whose variations could dramatically affect device figures of merit as responsivity or noise equivalent power. Fluences and energy spectrum of the neutrons impinging on the sensor prototypes were determined by a Monte-Carlo code implemented “ad hoc”. [All rights reserved Elsevier].
Number of references:22
Inspec controlled terms:barium compounds - high-temperature superconductors - ion beam lithography - magnetic field measurement - magnetic sensors - magnetoresistance - Monte Carlo methods - neutron effects - radiation hardening (electronics) - superconducting device noise - superconducting photodetectors - superconducting thin films - terahertz wave detectors - yttrium compounds
Uncontrolled terms:fast neutron irradiation - superconducting materials - terahertz photon detection - radiation-hard sensors - radiation hazard - accelerators - fusion machines - device

prototypes - magnetic field detection - YBCO superconducting films - Au-ion lithography - microcollimated implantation - high-density columnar defects - external electromagnetic excitations - dissipative signals - nanostructured regions - radiation hardness - detector prototypes - neutron fluence - permanence - superconductor characteristics - zero-field resistance-temperature - magnetoresistance - device figures of merit - noise equivalent power - neutron energy spectrum - Monte-Carlo code - electron volt energy 0.25 GeV - YBCO
Inspec classification codes:A6180H Neutron effects - A7470V Perovskite phase superconductors - A0755 Magnetic instruments and techniques - A7475 Superconducting films - A7220M Galvanomagnetic and other magnetotransport effects (semiconductors/insulators) - A0762 Detection of radiation (bolometers, photoelectric cells, i.r. and submillimetre waves detection) - A7430F Transport properties of superconductors - B7230C Photodetectors - B3220H High-temperature superconducting materials - B7310L Magnetic variables measurement - B3240R Superconducting receivers and detectors - B2550G Lithography (semiconductor technology)
Numerical data indexing:electron volt energy 2.5E+08 eV
Chemical indexing:YBCO/int CO/int B/int C/int O/int Y/int YBCO/ss CO/ss B/ss C/ss O/ss Y/ss
Treatment:Practical (PRA); Theoretical or Mathematical (THR); Experimental (EXP)
Discipline:Physics (A); Electrical/Electronic engineering (B)
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