

ABSTRACTS OF PUBLISHED PAPERS

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CONDENSED MATTER AND MATERIAL

Self-Limiting Effects of Flow Rate Modulation Epitaxy of GaAs on Patterned Substrate

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Journal of Crystal Growth **195** (1998) 586-590

A new self-limited growth induced by surface migration of Ga atoms during flow rate modulation epitaxy of GaAs on patterned substrate is demonstrated, which is considered to be very useful for the fabrication of many fine semiconductor structures, especially highly uniform quantum wires and quantum dots. The formation of stable surface reconstructions is proposed as a possible mechanism for this unique self-limiting phenomenon.

The Stability of Multiply Charged Vanadium, Niobium and Tantalum Clusters

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Chemical Physics Letters **300** (1999) 262-268

We have studied the stability of multiply charged vanadium, niobium and tantalum clusters with charges up to $z=4$. Although the multiply charged clusters are less stable compared with the prediction of the symmetric liquid droplet models, the experimental results can be explained well by an asymmetric fission model assuming an emission of an atomic ion.

Electron Probe Microanalysis of Second Phases via Acceleration Voltage Dependence

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Jpn. J. Appl. Phys. **38 Part 2** 1 A/B (1999) 96-98

The acceleration voltage dependence of electron probe microanalysis (EPMA) is discussed in relation to the determination of the compositional profile of a thin film. It is shown that the acceleration voltage dependence can be used to estimate the composition of second phase(s) by means of parameter fitting of an analytical model when the composition variation function is simple. The feasibility of the method is demonstrated using the example of molecular beam epitaxy grown CuGaSe_2 with a second phase. The composition of this phase is found to be Cu_3Se_2 consistent with X-ray diffraction results.

ELECTRONIC DEVICES

Fabrication of High Quality Superconducting Tunnel Junctions

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Jpn. J. Appl. Phys. **37** Suppl.37-2 (1998) 10-12

High quality Nb/ AlO_x /Nb superconducting tunnel junctions (STJs) are fabricated for the radiation detection. The fabrication process includes a MgO thin film, an underlayer method, a control of critical current, a nitrogen plasma passivation, and a SiO_2 insulating layer. Subgap current

characteristics of STJs have been investigated in the temperature range of 0.35K to 4.2K in order to evaluate the junction quality for the radiation detection. The STJs fabricated by present process show extremely high quality junction characteristics with a leakage current density of $0.1\text{pA}/\mu\text{m}^2$, a resistance ratio R_d/R_n of 6×10^6 for a $200 \times 200\text{-}\mu\text{m}^2$ STJ with a critical current density of $200\text{A}/\text{cm}^2$.

Large-Area Tunnel Junction Exhibiting Two Operating Modes for X-ray Detection

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Jpn. J. Appl. Phys. **37** Suppl.37-2 (1998) 25-30

High quality Nb-based tunnel junctions with surface areas of $100 \times 100\mu\text{m}^2$ and $200 \times 200\mu\text{m}^2$ were tested by irradiating x-rays. The $200 \times 200\mu\text{m}^2$ junction exhibited better x-ray response than that of the $100 \times 100\mu\text{m}^2$ one, due to better collection of quasiparticles. The junction detected 5.9eV x-rays with an energy resolution (FWHM) of 93eV and the energy required for single electron collection was 6.5meV. In the operation of the $200 \times 200\mu\text{m}^2$ junction, two kinds of operation modes with different pulse height were found by applying a magnetic field with different ramping speeds. The individual operation modes gave different current-voltage characteristics. The Sine-Gordon equation was employed to calculate the current-voltage characteristics for the large junction. From calculated results, it was confirmed that the higher pulse height operation mode was related to a large reduction of dc current through the junction.

Injection-Detection Experiments to Study Diffusion Process in Nb Film Using a Three Terminal In-plane Superconducting Double-Tunnel Junctions

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Superconducting tunnel junctions are promising devices in next generation nuclear and optical detectors. Unfortunately, a number of relaxation processes in the number of initially produced excitations degrades the performances of such devices. In order to investigate the role of charge loss mechanisms in Nb and/or Nb/Si interface we have fabricated three terminal in-plane double tunnel junctions, in which quasi-particles are injected into a Nb common strip and detected at different distances by tunnel junctions. The detection efficiency decreases of about one order of magnitude from $T=4.2\text{K}$ to $T=1.2\text{K}$ for any injector-detector distance. The presence of charge trapping centers, activated at low temperatures, can qualitatively explain such a result. The estimation of the quasi-particle diffusion constant of $28 \pm 5\text{cm}^2/\text{s}$ at $T=1.2\text{K}$ is in agreement with other similar values reported in literature.

INFORMATION SCIENCE

Performance Evaluation of Popular Distributed Object Technologies for Java

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Journal of CONCURRENCY PRACTICE AND EXPERIENCE **10** 11-13 (1998) 927-940

System development using Java and distributed object technology (DOT) is becoming common, and can become the standard way of doing network computing in the near future. The performance of DOTs is crucial in high-performance network computing systems. In this paper, the performance of popular DOTs for Java is evaluated in a common environment employing the fastest available PCs and 100Mbit/s Ethernet. We evaluate HORB, Java RMI, Voyager, two commercial CORBA IIOP implementations, and Distributed COM. For comparison a Java socket version and a C socket version are evaluated. To represent the characteristics of the DOT, the performance of primitive object operations including remote

object creation, remote method call, transferring arrays of objects and transferring large numerical data is measured and evaluated. No DOT won all benchmarks, but HORB showed very good performance for most benchmarks.

OPTICS AND RADIATION

Diffusion Loss of Ions and Charge Collection Volumes for Thimble Type Ionization Chambers

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Radiation Protection Dosimetry **81** 3 (1999) 229-232

Decrease in signal current due to back diffusion of ions in a thimble type ionization chamber was obtained from electric potential distributions in the chamber. They were also estimated by equations of back diffusion loss for cylindrical and spherical chambers. The results from these two estimates were very close because the electric field in the thimble chamber is similar to the combination of the ideal cylindrical and hemispherical shape chambers. It was also found from the electric potential distributions that the charge collection volume of the thimble ionization chamber was different from that obtained from the mechanical design of the chamber, due to distortion of the electric field at the boundary of the collection volume in the cylindrical portion of the chamber. It was shown that there is a critical separation position between the guard electrode and polarizing electrode, for which the effect of the distortion was minimized.

High-Dynamic-Range Autocorrelation Measurement of Amplified Pulses

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The Review of Laser Engineering **26** 12 (1998) 892-894

We characterize 25-fs pulses from a Ti:sapphire multipass amplifier system using high-dynamic-range third-harmonic-generation autocorrelation technique, which enables us to observe the asymmetry of amplified pulses. We have succeeded to suppress the background on the leading edge using positive-third-order-dispersion chirped mirrors.

Double Peak Phenomenon in Superconducting Tunnel Junction X-Ray Detectors

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J. Appl. Phys. **85** 1 (1999) 595-599

It has been normally observed that superconducting tunnel junction x-ray detectors produce a double peak originating from different absorption events in two electrodes. The double peak is associated with the dynamics of quasiparticles created by x-ray absorption events. In this study we have found that the double peak phenomenon depends on both bias voltage and magnetic history. These observations are explained by a multiple quasiparticle tunneling model with quasiparticle trapping in Abrikosov vortices.

ENERGY TECHNOLOGY

Review of the Electrical Insulation of Superconducting Generators

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Cryogenics **38** 11 (1998) 1155-1158

Superconducting generators have been developed in several countries. Field windings of them are made of NbTi superconductor and cooled with liquid helium. Electrical insulation of the field winding has to withstand high voltage during normal and abnormal operation, and also has to support the conductor against large centrifugal force and Lorentz force. This paper reviews the electrical insulation designs of the field windings of superconducting generators, mainly those of the latest Japanese generators.