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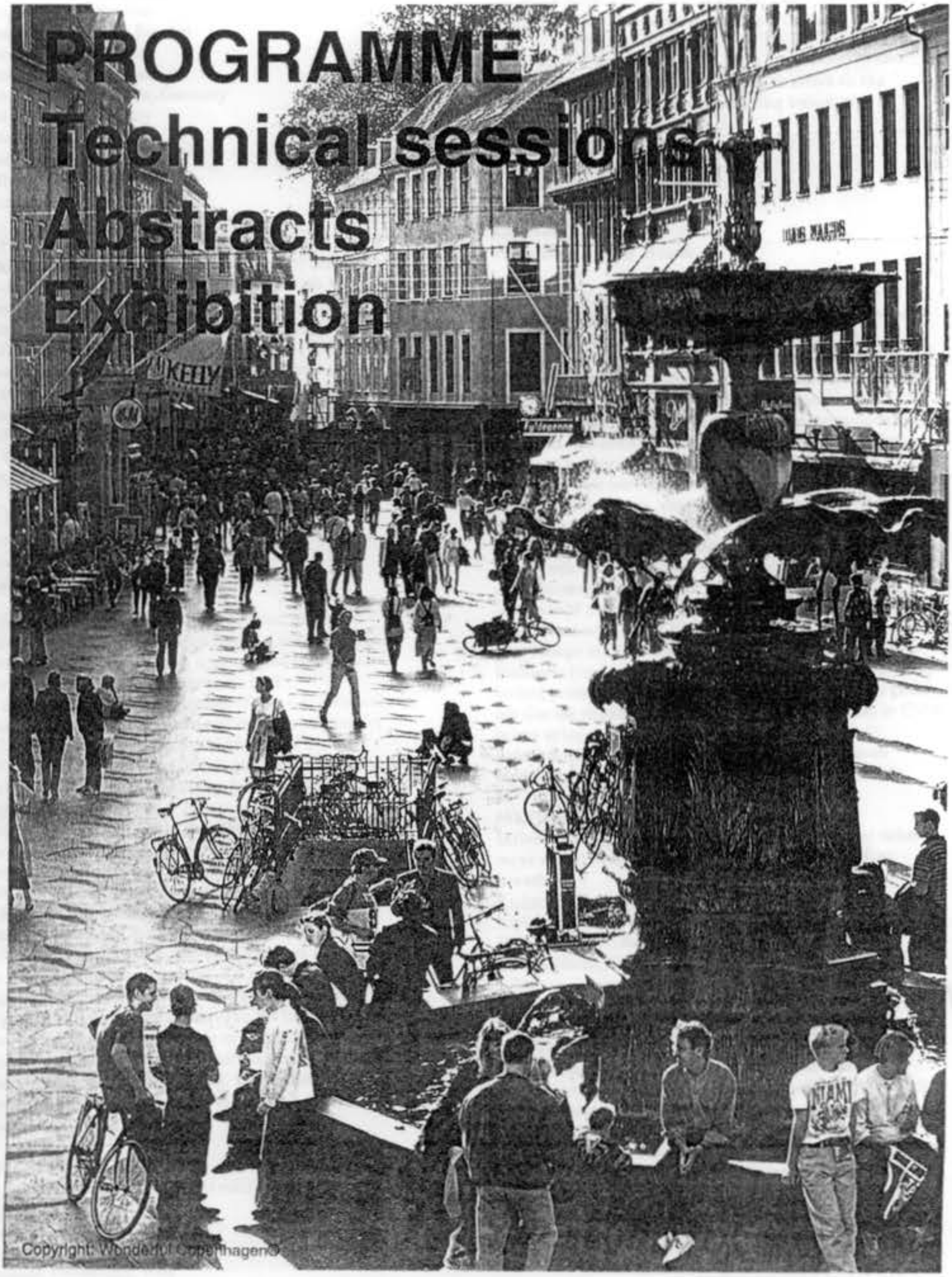
PROGRAMME
Technical sessions
Abstracts
Exhibition



POSTER SESSION D.1

LTS and HTS junctions and circuits I

August 27th, 2001, 16:15-18:00

D1.1-02

Influence of thermal cycling on Tow Level Fluctuation observed in epitaxial NbN/MgO/NbN tunnel junctions

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We have investigated the influence of thermal cycling on Tow Level Fluctuation (TLF) observed in NbN/NgO/NbN superconductor-insulator-superconductor tunnel junctions epitaxially grown on MgO(100) single crystals. The measured power spectral density Sv(f) had a Lorentzian frequency dependence as expected from the Machlup formula for random telegraph noise. These spectra disappeared and appeared during the repeated thermal cycling between 300 and 4.2 K. The applied voltage dependence of the Lorentzian corner frequency for NbN/MgO/NbN junctions were was explained by thermal activation model. As pointed by Weesley et al., pure MgO barriers are oxygen deficient and easily adsorb hydroxide. These defects and hydroxide generally act as a 1/f noise source in NbN/MgO/NbN junctions. The results on thermal cycling for NbN/MgO/NbN unctions, however, indicate that the TLF source in these epitaxial tunnel junctions is stress induced in a thin film during thermal cycling because of the difference in the thermal-expansion coefficients for the film and the substrate.

D1.1-03

Double-barrier Josephson junctions with high critical parameters

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At present, technical realization of the superconducting digital circuits demands overdamped Josephson junctions with a moderate critical current density, j_c, of order 20 kA/cm^2. Among the candidates (SNS, SIS, and SINIS junctions) suitable for this practically important j_c region, the SINIS junctions seem to be most promising (here S, I, and N denote superconductor, insulator, and normal metal, respectively). However, the SINIS junctions fabricated so far using the Nb/Al technology, demonstrated too low (~0.3 mV) critical voltage. In this work, it is shown that asymmetric SINIS junctions with different transparency of the two tunnel barriers may have higher critical voltages than analogous symmetric junctions at 4.2 K. Also, the double-barrier junctions with a complex (NS'N) interlayer were fabricatedand investigated for the first time. If the thickness of the S' layer is very thin, the SINS'NIS junctions have quasiparticle current-voltage characteristics similar to those of conventional SINIS junctions at 4.2 K, but the Josephson critical current densities, and therefore, the critical voltages, are much higher than the corresponding values for the SINIS junctions.

D1.1-06

Pulsed-assisted escape from zero voltage state in Josephson systems.

Rotoli, Giacomo, Italy
De Leo, Cinzia, Italy
Pepe, Giovanni Piero, Italy
Barone, Antonio, Italy
Peluso, Geppino, Italy
Parlato, Loredana, Italy

The behavior of a Josephson system under pulsed operation is of utmost importance for developing reliable digital devices workingat very high clock frequencies. Information about effect of thermal noise over pulsed operation is also useful to designerrors free devices.

Recent experiments in a system of two stacked junctions [1] show that a pulsed operation on the first junction (injector) of the stack drive the Josephson biased second junction (detector) into theresistive state. The experiment was interpreted as pulsed-assisted escape toward resistive state as a consequence of an excitation of non-linear oscillations in the detector junction that, with thecontribution of thermal noise, drives out the junction from the zero voltage state. Moreover, in the same experiment foran unstability of the resistive state toward the zero voltage state under the pulsed operation was also noted.

By means of a systematic numerical approach to the problem, we present a study of the pulsed-assisted escape using the framework of the thermal escape theory for both direct transition from zero voltage state to resistive state, and the return transition from resistive to zero voltage. We study the single junction case, both small and long, and the stacked junctions case as examples of three different systems showing pulsed-assisted escape.

[1] G.P.Pepe et al., Pulse-induced switches in a Josephson tunnel stacked device, submitted to Appl.Phys.Lett. March 2001.

D1.1-07

Physics of double-barrier Josephson junctions

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Rogalla, Horst, The Netherlands
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New theoretical results on double-barrier SIS'IS Josephson junctions are presented (I is a tunnel barrier, S' is a superconducting thin film with critical temperature lower than that of S). The general solution of the microscopic equations that describe the electronic transport through double-barrier Josephson junctions is studied. The interplay between Andreev- and transmission-resonances describes the crossover from phase coherent transport to a regime where coherence is lost. This results in a specific dependence of the Josephson supercurrent on temperature and barrier strength, which agrees well with available experimental data. The microscopic model for the stationary case is extended to the non-equilibrium regime of finite voltages by means of the Keldysh formalism, in order to explain current-voltage data.

D1.1-10

Current-phase relationship of Nb/InAs/InAs(2DEG)/InAs/Nb Josephson junctions

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We have measured the current-phase relationship (CPR) ofNb/InAs-InAs(2DEG)-InAs/Nb Josephson junctions with highlytransparent interfaces. The Nb electrodes defined by e-beamlithography are weakly coupled by the two-dimensional electron gas(2DEG) that forms at the surface of p-type InAs single crystals.