

Low Temperature Scanning Synchrotron Microscope

Uptec







PF@KEK, TERAS@AIST



5 - 10µm x-ray microbeam



MAR

Und-10-geiling

6 keV - 20 keV, Multipole Wiggler + Si(111)



70 - 1900 eV, Bending magnet + Grating Scanning has not been available by LTD.





R. Cristiano et al., J. Appl. Phys. 86, 4580 (1999).





- junction size,
- strength of magnetic field,
- thickness of Al layers (vist J11, M. Ukibe et al.), and
- photon energy (this study).









Spatial profiles at 6 keV and 1.74 keV

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200µm square, Al 30nm





SiK α (1.74keV)

a

AS



0 ∟



The spectrum for 520 eV and 1040 eV shows the same large spatial nonuniformity as for 1.74 keV and 6keV.

Channel



Smaller junctions help us.

100 μ m square, Al 30nm τ =1.3 μ s autoniced 500 520eV 2nd-order photons due to a mylar filter 400 Ud-10.90 1040eV Yield [counts/channel] 300 FWHM=32eV Intrinsic FWHM=29eV Pulser 200 100 0 800 200 400 600 1000 Channel

The spectrum of the 100 μ m-square junction for 520 eV shows that the spatial nonuniformity is small.



Photon energy [eV]





Energy linearity and FWHM

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Conclusions

- Spatial profile strongly depends on photon energy.
- Response to low energies (< ~1 keV) may be within conventional quasiparticle diffusion model. The uniformity and *E*-linearity is improved by increasing the AI thickness.
- Response to high energies (> ~1 keV) requires new signal creation framework (high density of excitation, too far from equilibrium state).
- Full understanding of STJ operation requires an advanced nonequilibrium theory and further LTSSM studies.
- Stephan's favorite 50nm AI may be good for energy resolution, response time, and detector size in < 2 keV.</p>
- Junctions have a high energy resolution, a high count rate, and a reasonable detector size for soft X-ray spectroscopy.







Prototype of array









Next step

• Make scanning below 2 keV, and reconfirm today's discussion directly.

Spatial nonuniformity of the junction with 30-50nm
Al should be studied further to get a high count rate.

Thicker Nb electrode or Ta electrode to cover up to 2 keV, and array.

LTSSM measurements with constant voltage bias should be done to make tunneling process more simple. (Yale-LLNL current amplifier)