

## 0099 - S1. Junctions

### Hybrid Josephson heterostructure with high magnetic field sensitivity

Gennady A. Ovsyannikov<sup>1</sup>, Philipp V. Komissinskiy<sup>3</sup>, Igor B. Borisenko<sup>1</sup>, Yulii V. Kislinskii<sup>1</sup>, Karen Y. Constantinian<sup>1</sup>, Alexandr V. Zaitsev<sup>1</sup>, Dag Winkler<sup>2</sup>

<sup>1</sup>*Institute of Radio Engineering and Electronics Russian Academy of Sciences, Russian Federation,*

<sup>2</sup>*Department of Microtechnology and Nanoscience, Chalmers University of Technology, Sweden,*

<sup>3</sup>*Department of Materials Science, Darmstadt University of Technology, Germany*

Dc and ac Josephson effects in hybrid  $\mu\text{m}$ -size s-wave superconductor – normal metal – antiferromagnet – d-wave superconductor Nb/Au/Ca<sub>1-x</sub>Sr<sub>x</sub>CuO<sub>2</sub>/YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  mesa heterostructures (MHS) were experimentally demonstrated using antiferromagnetic (AF) Ca<sub>1-x</sub>Sr<sub>x</sub>CuO<sub>2</sub> (CSCO) interlayers. The Au normal metal layer provides good contact both to the CSCO interlayer and to the s-wave superconductor (Nb) having strong proximity effect in the Au layer. Josephson characteristic voltage  $V_c = I_c R_N = 100\text{-}300 \mu\text{V}$  was demonstrated in the MHS with CSCO AF layer up to 50 nm thickness. Possible influences of micro-shorts in the investigated MHS were ruled out from high frequency measurements. The ac Josephson effect was manifested by the oscillating power dependence of the Shapiro steps, which could be well fitted to RSJ model for dc measured parameters. The observed high values of the critical current density  $j_c$ , up to  $200 \text{ A/cm}^2$ , and  $V_c$  can be explained by a transformation of the complex ( $d\pm s$ )-wave superconducting order parameter of YBCO into the s-wave one at the magnetically active Au/CSCO interface of the MHS, resulting in a deep penetration depth in AF layer up to a distance of a few nanometers. An interesting feature observed for MHS was that in addition to the conventional Fraunhofer-like magnetic field pattern,  $I_c(H)$  exhibits anomalously rapid oscillations, which may be the first experimental evidence of the theoretical prediction of giant magneto-oscillations in S/AF/S Josephson junctions by L. Gorkov and V. Kresin [1,2].

Partial support of the Russian Academy of Sciences, Russian Foundation for Basic Research, Russian Ministry of Sciences and Education, the AQDJJ and THIOX programs of ESF, Swedish KVA, SI and SSF "OXIDE" programs and NANOXIDETTC project of EU are acknowledged.

[1] L. Gor'kov and V. Kresin, Appl. Phys. Lett. 78, 3657 (2001).

[2] G. A. Ovsyannikov *et al.*, JETP Lett. 84, 262 (2006)