T_CSUH/IEEE Council on Superconductivity Distinguished Lecturer

Texas Center for Superconductivity at the University of Houston

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Are all HTS Josephson Junctions the Same?

Wednesday, July 16, 2008
Room 102, University of Houston Science Center
12:00 Noon – 1:00 p.m.

Abstract

Josephson junctions are the basis of all active superconducting electronics. Since the discovery of high temperature superconducting (HTS) materials and YBCO, in particular, a number of different methods of junction fabrication have been devised on a range of different substrates; grain boundary step-edges, bi-epitaxial, bi-crystal and ramp junctions are common examples. The properties of these junctions vary with differences in the range of critical currents and normal resistance that are achievable, their response to magnetic fields and the amount of s-or d-wave phase shifting across the junction. Superconducting electronic applications are broad ranging including SQUIDs for magnetometry, gradiometry, macroscopic quantum state formation for quantum computer qubits, and microwave and terahertz resonators and detectors. However the requirements of the Josephson junction for each of these applications are quite different. This paper will review four different Josephson junction types and what their properties are by considering the impact of the junction morphology and the substrate material on their demonstrated characteristics. We will report on various devices fabricated at CSIRO and use some data from the literature. We will show that these different junctions have different s- and d-wave contributions as well as other properties that make different junctions more appropriate for each specific application in superconducting electronics.

Bio

Dr. Cathy Foley is a Senior Principal Research Scientist and Research Program Leader in Materials Physics with CSIRO Materials Science and Engineering. She is developing High and Low Temperature Superconducting systems for Mineral Exploration, detection of metal for quality assurance in manufacturing, electrode-less heart monitors and remote detection of contra band at airports. This multiple million-dollar project assisted with the discovery and delineation of the BHP Cannington Silver mine and her team is currently commercialising their systems. Her group were the first team to successfully fly superconducting systems. Cathy has a world class reputation in her field being a Fellow of the Institute of Physics in the UK and President of the Australian Institute of Physics.

Dr. Foley is well known for her interests in physics, science education, women in science, science in the media (she was a regular weekly guest on ABC radio 2BL radio for 5 years). She has been recently involved in developing the passion for science within CSIRO and renewing what it is to be a scientist. She has been awarded the Public Service Medal and Eureka Prize in 2005 and is the IEEE 2007-2008 Distinguished Lecturer which is a USA based honour.

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