IEICE Transactions on Electronics

Special Section on Recent Progress in Superconducting Analog Devices and their Applications

August 5, 2009 (HP22). With a regrettable delay of several months we like to attract the attention of our readers to the "Special Section on Recent Progress in Superconducting Analog Devices and their Applications" published in the March 2009 issue (No. 3) vol. E92-C, of the Japanese *IEICE Transactions on Electronics*. Beginning with 2009, this journal is published directly by IEICE (The Institute of Electronics, Information and Communication Engineers). Unfortunately, it is not subscribed to by most of Western institutional libraries. However, the contents list and abstracts are available free-of-charge at:

http://search.ieice.org/bin/index.php?category=C&year=2009&vol=E92-C&num=3&lang=E&abst=

Access to full text (PDF) articles requires logging in; this is possible only for members of IEICE in good standing. At some later time, we hope to receive and publish an overview article by Dr. Keiichi Tanabe (ISTEC), who is the Guest Editor of the 2009 Special Section. In the interim, this overview should provide slightly more information than the freely accessible abstracts. Our readers, who are interested in the prompt reading of any of the full text articles should contact the corresponding author (CA) and request a reprint. The Special Section consists of 8 invited papers, grouped in two subsections: "Microwaves" and "SQUIDs". Here, we list titles of these 8 articles. Each title is listed with the respective CA's name and his e-mail address. Please replace "(at)" by "@" before mailing.

Microwaves

1. "Spurious suppression effect by transmit bandpass filters with HTS dual-mode resonators for 5 GHz band":
   Mr. Kazunori YAMANAKA yamanaka-kaz(at)jp.fujitsu.com
2. "Superconducting narrowband filter for receiver of weather radar":
   Mr. Tamio KAWAGUCHI tamio.kawaguchi(at) toshiba.co.jp
3. "Automatic trimming technique for superconducting band-pass filters using a trimming library":
   Prof. Shigetoshi OHSHIMA ohshima(at)yz.yamagata-u.ac.jp
4. "A novel filter construction utilizing HTS reaction-type filter to improve adjacent channel leakage power ratio of mobile communication systems":
   Mr. Shunichi FUTATSUMORI futatsumori(at)emwtinfo.ice.eng.hokudai.ac.jp

SQUIDs

5. "Liquid-phase detection of biological targets with magnetic marker and superconducting quantum interference device"
   Prof. Keiji ENPUKU enpuku(at)sc.kyushu-u.ac.jp
6. "High-Tc SQUID detector for magnetic metallic particles in products"
   Prof. Saburo TANAKA tanakas(at)eco.tut.ac,jp
7. "New approach of laser-SQUID microscopy to LSI failure analysis"
   Dr. Kiyoshi NIKAWA k.nikawa(at)necel.com
8. „Transition edge sensor-energy dispersive spectrometer (TES-EDS) and its applications"

Dr. Keiichi TANAKA keiichi.tanaka(at)siint.co.jp

Below, we briefly highlight the two lead articles (No. 1 and No. 5) of the two subsections.

The first paper, by Yamanaka *et al*., overviews the principal issues in broadband *transmitter* filters for wireless communication in the low microwave band, which can handle moderate output power, up to 40 dBm, namely:

- The rf transmitter and its performance.
- The bandpass resonator quality factor and effect of HTS material.
- Cryo-packaging.
- The disk patch dual-mode filter design and simulated performance of cascade filters, consisting of up to eight resonators.
- The real test performance of an eight-resonators filter in 5 GHz band.

In that test, the signal generator operation was programmed to generate modulation signal with a wider band than expected in future applications of broadband wireless communication. The protocol was the extended IEEE 802.16e-2005, with a kind of OFDM method secondary modulation. Figure 1 below (similar to Fig. 11 of the paper) compares the transmitter output power density spectrum without (P-1) with that (P-2) obtained after inserting the tested filter.

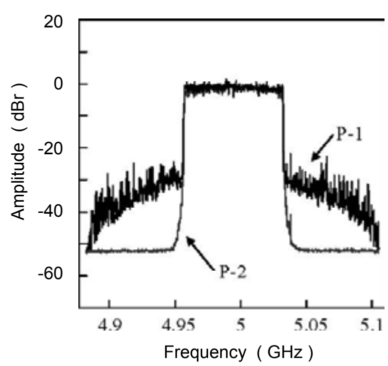

Fig. 1. Yamanaka et al. Fig.11. Power density spectra without (P-1) and with (P-2) the tested 8-resonator bandpass filter.

The paper by Enpuku *et al*., overviews the biological magnetic marker detection in liquid phase using SQUID as a sensor, and presents current results attained in Japan through collaboration between academia (Enpuku's group at Fukuoka University) and the electronic and pharmaceutical industries (this paper's authors are affiliated with 6 different organizations). This already well-known approach to immunoassays and the detection of biological targets exploits the difference in magnetic relaxation characteristics of markers freely moving in the solution (Brownian relaxation) and of those bound to a specific biological target (Néel relaxation).

Developmental polymer-coated Fe_3O_4 nanoparticles 20 to 25 nm in diameter have magnetic properties typical of larger particle agglomerates. From measured frequency spectra of complex magnetic susceptibility the authors determine the particle size distribution peaking at ≥ 100 nm, in reasonable agreement with that obtained by dynamic light scattering. From the particle size distribution, the Brownian relaxation time of free, unbound markers is estimated to be in the range between about 50 μs and 25 ms. Néel relaxation was determined on frozen samples, with much longer relaxation times between nearly 4 and 90 s.

After presenting the principle of liquid phase immunoassays, the authors show three examples of their experimental results. Figure 2 (modified Fig. 9 of the paper) illustrates one of these: the detection of the fungus *Candida albicans* particles (size of about 4 μm) using biotin antibodies as schematically shown on the left side of Figure 2. The plot on the right side shows the magnetic signal versus the number *N* of fungi at two values of applied magnetic field. The authors are convinced of the practical value of their method.

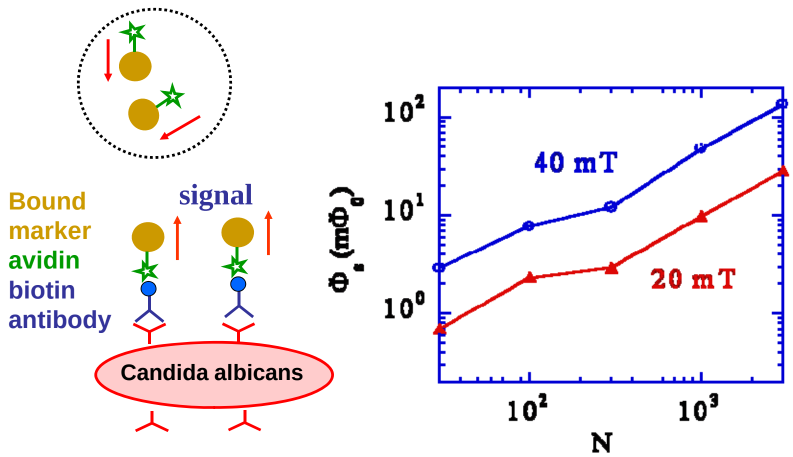

Fig. 2. Enpuku et al. Fig.9: Left – schematics of fungus detection method.
Right: Detected signal versus the number of detected fCandida albigans fungi.