

Development of Magnetic Prospecting System with HTS SQUID Gradiometer for Exploration of Metal Resources

Akira Tsukamoto¹, Tsunehiro Hato¹, Seiji Adachi¹, Masayuki Motoori², Masaki Sugisaki², Keiichi Tanabe¹

¹SRL-ISTEC

Minowa-cho, Kohoku-ku, Yokohama, Kanagawa 223-0051, Japan

²JOGMEC

Toranomon, Minato-ku, Tokyo 105-0001, Japan

E-mail: tsukamot@istec.or.jp

Abstract — We have developed a magnetic prospecting system with HTS SQUID gradiometers for exploration of metal resources. The SQUID gradiometer consists of a flux transformer chip made of a YBCO thin film and a SQUID gradiometer chip which is stacked on the transformer chip. The SQUID gradiometer chip was fabricated by using an HTS multilayer and ramp-edge junction technology at ISTEC. Their effective volume and the balance estimated by using a Helmholtz coil were approximately $3 \times 10^{-9} \text{ m}^3$ and 1/500, resulting in the gradiometric field noise of $7 \text{ pT/m/Hz}^{1/2}$ at 10 Hz. Two assembled SQUID gradiometers, which measure dB_z/dx and dB_z/dy field gradients, were cooled with liquid nitrogen in a cryostat of the magnetic prospecting system. The cryostat was suspended from the frame of the system and its attitude was self-controlled by gravity. The magnetic prospecting system with the HTS SQUID gradiometers, flux-gate sensors, a GPS module, and a gyro sensor was also tested in a field near an old mine.

Keywords (Index Terms) — HTS-SQUI, gradiometer, mineral exploration, flux transformer.