

Development of High-Tc Superconductor Applications in New Zealand: Present Status and Future Prospect

Chris W. Bumby¹, Donald Pooke², R.G. Buckley¹, N.J. Long¹, R.A. Badcock¹

1 Robinson Research Institute, Victoria University of Wellington, Wellington, New Zealand

2 HTS-110, 1B Quadrant Drive, Lower Hutt 5010, New Zealand

Email: chris.bumby@vuw.ac.cn

Abstract— New Zealand maintains a long-standing and broad-ranging development programme in high temperature superconductor (HTS) applications, which spans from conductor development through to the commercial supply of magnet systems. In recent years, there has also been a growing focus on HTS power system development for both grid-based and electric-hybrid applications. The R&D programme is primarily hosted within NZ's premier centre for superconductivity research, the Robinson Research Institute at Victoria University of Wellington, whilst HTS magnets, cables and cryostats are commercially manufactured and supplied by the New Zealand companies, HTS-110, GCS Ltd and Fabrum Ltd. This talk will present an overview of some of the key development activities being pursued by New Zealand researchers and companies. In many cases this work is taking place within large international programmes, with NZ partners delivering key system components. Current projects include the development of cryogen-free conduction-cooled HTS magnetic resonance imaging systems at 1.5 T and 3 T. Other recently developed scientific magnets include an HTS system for $I_c(B, \vartheta, T)$ measurements of commercial superconducting wires at $I \leq 900$ A, $T \geq 18$ K and $B \leq 8$ T. HTS-110 have also recently supplied several custom-designed beam-line magnets to international synchrotron and neutron beam facilities. In the power systems area, HTS rotating machines are a key focus, including the development and supply of HTS rotor coils for ultra-high speed generators, and the development of prototype integrated brushless "flux-pump" exciters for HTS generators. In addition, GCS Ltd. operates a pilot manufacturing plant for the production of high current capacity transposed HTS Roebel cable which minimizes AC-loss in applications such as power system components and fast-ramping high-field magnets.

This talk will outline the objectives, challenges and progress in these projects, as well as discussing the future prospects for further development and commercial uptake.

Keywords (Index Terms)— HTS, NMR, MRI, high field magnet, generator, Bi-2223, coated conductor.

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