

Current Superconductivity and Cryogenics Research in New Zealand

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Abstract— New Zealand continues to have a vigorous programme of research in high temperature superconductivity (HTS). In materials development we have a small project on Fe-based superconductors for wire applications and we continue to support international manufacturers with contract research. We retain the capability to manufacture Roebel cable from REBCO wire which remains the only viable option for creating low loss HTS transformers. We are a partner in a project with China to use Roebel cable for a REBCO traction transformer. Characterisation of critical current with angle, field and temperature, $I_c(B,\theta,T)$, is becoming increasingly important for effective use of REBCO wire. We have developed a measurement system which has led to a useful database of critical current data for application developers, and we have sold several of these systems to industry. Our MRI development is continuing in partnership with the University of Minnesota, USA to build a head- only functional MRI system. Like many other groups we are active in investigating novel insulation or no-insulation systems to improve the magnet performance. With the motivation of reducing greenhouse gas emissions in aviation we are researching rotating HTS machines for their high power to weight ratio. A key technology is to excite the rotor coils using an HTS dynamo or ‘flux pump’. This is a technology we are interested in developing for multiple applications. Reducing heat leaks and the overall weight of HTS systems opens the possibility to use superconductors in satellites and space where they may have many applications. We are evaluating several uses for superconductors in space.

Keywords (Index Terms) — HTS, Fe-based superconductors, Roebel cable, REBCO, HTS transformer, functional MRI system, rotating HTS machines, flux pump, space applications.

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