THE FIRST REPETITIVELY PULSED MAGNET PROTOTYPE

C.A. Swenson, M.D. Bird, A.V. Gavrilin, S. Gundlach, K. Han, and W.S. Marshall (NHMFL-FSU)

Introduction

The first prototype of a split-gap repetitively pulsed magnet suitable for neutron scattering experiments has been delivered to the NHMFL Pulsed Field Facility for testing (See Fig. 1). The magnet design consists of two high current-density, variable-pitch, copper-alloy coils welded to an aluminum-alloy mid-plate. The copper alloy provides high electrical conductivity and mechanical strength while the aluminum alloy provides high transparency to neutrons. The cylindrical weldment is cut into a helix via wire electro-discharge machining (EDM) (See Fig. 2).

Recent Experience

Fabrication of the helix was completed some time ago. Recently, manpower became available to continue with development and fabrication of the inter-turn insulation and the zylon composite over-banding systems (See Fig. 3). A spin coating process was developed to insulate the windings with high voltage insulation. Particular attention was paid to the mechanics of the reinforcement interface proximal to the friction weld. In addition, a clamping frame with integral lead supports was developed (See Fig. 1).

Summary

We have completed the development, design, and fabrication of the first RPM prototype. A test protocol has been written and delivered to LANL with the coil. The friction-bonded helix technology is unique and required development of new welding, EDM, insulation and reinforcement procedures. Significant production experience was gained developing processes and tooling to produce the first prototype. We intend to continue with the development of additional prototypes to demonstrate the unique features associated with higher voltages, larger coils, multiple nested coils, fatigue, high heat fluxes, etc. prior to building a user system. The test results from this first prototype will drive the development plan for the next prototype.