

Recent Results in Second-Generation HTS Wire Technology Development at SuperPower

Y.-Y. Xie*, Y. Chen, X. Xiong, X. Zhang, A. Rar, M. Martchevskii, Y. Qiao, A. Knoll,
R. Schmidt, K. Lenseth, D. Hazelton, and V. Selvamanickam
SuperPower, Inc., USA

With 2G HTS wires delivered from SuperPower's pilot manufacturing line, a number of devices have been successfully fabricated and shown excellent performance. Using nearly 10,000 m of 2G wire, Sumitomo Electric has successfully constructed a 30 m, 3-phase, fully-shielded cable. This cable has been installed in the power system of National Grid in Albany and is the world's first 2G device in a live power grid. High-field magnets have been constructed with our wire. A world-record field of 9.8 T was generated in a 2G coil at 4.2 K and a record field of 26.8 T was generated in a background field of 19 T at 4.2 K. These successes show that SuperPower's 2G HTS wires are suitable for real-world applications. Nevertheless, in order to gain further market penetration, it is essential to improve the price-performance characteristic of 2G wire through technology development. SuperPower has been focused on achieving higher levels in three key technical metrics: high critical current, high throughput, and long single-piece lengths. Remarkable progress has been made in all three key metrics in the last year. By improving thick film properties and modified superconductor compositions in our MOCVD process, critical currents as high as 813 A/cm or 976 A have been achieved over 1 m length and 12 mm width. We have increased the processing speeds of Alumina and Yttria to 750 m/h, IBAD-MgO to 360 m/h, homo-epi MgO to 345 m/h, LMO to 345 m/h, and MOCVD to 180 m/h (all values are 4 mm wide tape equivalent). At these high speeds, we are routinely producing substrates with 5-layer full buffer structure in more than 1 km length. The quality of the buffered tapes is excellent with an in-plane texture of 6 – 7 degrees and uniformity of about 2 % over the entire lengths. At MOCVD process speed of 135 m/h, 935 m long 2G wire has been made with minimum $I_c = 170$ A/cm at 0.2 μ V/cm voltage criterion.

Acknowledgment:

Program funding from Title III and DOE through UT-Battelle & AFRL. Supported by CRADAs with Oak Ridge, Los Alamos, and Argonne National Laboratories