Progress in Performance Improvement and New Research Areas for Cost Reduction of 2G HTS Wires

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Abstract - Second-generation (2G) HTS wires are now being produced routinely in kilometer lengths using Metal Organic Chemical Vapor Deposition (MOCVD) process with critical currents of 300 A/cm. While this achievement is enabling several prototype devices, in order to reach a substantial commercial market, the cost-performance metrics of 2G HTS wires need to be significantly improved in device operating conditions. Zr-doping has been found to be an effective approach to improve in-field critical current performance of MOCVD-based HTS wires. In this work, we have explored modifications to the Zr-doped precursor compositions to achieve three and two-fold increase in deposition rate in research and production MOCVD systems respectively. Production wires made with modified Zr-doped compositions exhibit a self-field critical current density of 50 MA/cm^2 at 4.2 K and a 55 to 65% higher performance than our previous wires with Zr-doping, over magnetic field range of 0 to 30 T. We have also developed an alternate, low-cost technique, namely electrodeposition, to deposit silver overlayer on superconducting film. Wires made with electrodeposited silver are able to sustain the same level of overcurrent as sputtered silver layers. This process has been successfully scaled up to 100 m lengths.

Index Terms - second-generation HTS, MOCVD, critical current, magnetic field, long length, BZO, Zr, silver, electrodeposition

IEEE/CSC & ESAS European Superconductivity News Forum (ESNF), No. 14, October 2010
The published version of this manuscript appeared in *IEEE Transactions on Applied Superconductivity* 21, Issue 3, 3049 - 3054 (2011)