

Development of YBCO Coated Conductor by MOCVD Method

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Many research efforts have been directed toward developing YBCO high-temperature superconducting (HTS) wire technologies in order to realize a high critical current density at 77 K. There are two types of approaches for the realization of a high- J_c YBCO coated conductor (CC) : (1) YBCO films on polycrystalline metal substrates with artificially textured buffer layers; (2) YBCO films on textured metal substrates with or without buffer layers. Typical method for making a textured buffer layer in the first approach is an ion beam assisted deposition (IBAD). The second method is related to the rolling assisted biaxially textured substrate (RABiTS). Cube-textured Ag tape (without buffer layer), cube-textured Ni tape (with buffer layer) and surface oxidation epitaxy (SOE) are included in this field. The YBCO films and buffer layers could be deposited by using various methods such as a metal organic chemical vapor deposition (MOCVD), pulsed laser deposition (PLD), metal organic deposition (MOD), co-evaporation, sputtering etc.

Since the first report on the synthesis of YBCO film by the CVD process in 1988, many researches on the equipment and source materials have been performed. Although the CVD process has many kinds of merits, as proven in semiconductor production, there are still problems to be solved in oxide CVD when conventional solid state sources are used. As an example, there is a poor reproducibility of the deposition associated with solid-state sources. Therefore, to improve the oxide CVD growth, a liquid source dissolving the solid sources into a solvent has been used. There are several groups studying the YBCO CC by a MOCVD process in USA, Japan and Germany. IGC superpower in USA has obtained good results with high critical current and long length.

We have fabricated a textured Ni-alloy substrate by powder metallurgy method, and developed two different types of MOCVD systems with a hot-wall type reel-to-reel reactor and a cold-wall type using a single source for the YBCO CC application. The new first buffer layers like $(Y_xSm_{1-x})_2O_3$ and Yb_2O_3 using water vapor as an oxygen source was fabricated on (100) textured Ni-W metal substrate. The YBCO film was deposited on various templates, and the structural and electrical properties of the films were examined.

Keywords : YBCO coated conductor, MOCVD, buffer layer