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M1Or3B-04 [Invited]: Progress in scale up of thick-film 2G-HTS with artificial pinning centers

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Dramatic improvement in in-field performance of thick 2G-HTS tapes has been recently achieved in $>4 \mu\text{m}$ thick REBCO films over a wide range of field and temperatures, as demonstrated by the resulting engineering current densities, J_E , of over 15 MA/cm^2 at 30 K, 3 T and over 5 kA/mm^2 (0.5 MA/cm^2) at 14 T, 4.2 K, which is over five times higher than that of Nb₃Sn. The ability to control film quality at high film thickness has been addressed by the development of an Advanced MOCVD (A-MOCVD) deposition system, while the maximization of in-field performance has been achieved by progress in understanding of control of Artificial Pinning Center (APC) size, density and morphology.

In this talk, the progress in scale-up of the A-MOCVD + APC technology will be presented. The details associated with scale-up will be outlined. In addition, the progress in inline quality control metrology and real time process feedback will be presented. In particular, incorporation of an inline 2D-XRD system into A-MOCVD will be discussed, along with the identification of key features of the XRD footprint that enable not only identification of film growth quality, but also identification of APC morphology, density and in-field performance. The effect of composition and type of APCs on stability and repeatability of performance will be discussed. Progress in process efficiency improvement will be presented. Finally, newly discovered features of in-field performance will be presented that enable long-length characterization of in-field performance over a wide range of fields and temperatures based on Pearson Correlation characteristics of thick REBCO films with different APCs.

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