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Progress in ultrafast transient liquid assisted growth of high current density superconducting films and coated conductors

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High current superconducting wires have been one of the most challenging achievements during all the HTS era which encompasses many materials science and engineering challenges. Coated conductors of $YBa_2Cu_3O_7$ (CC-YBCO) have emerged as the most attractive opportunity to reach unique performances at high an low temperatures, while reducing the cost/performance ratio continues to be a key objective for their marketability. Chemical solution deposition (CSD) is a very competitive cost-effective technique which has been used to obtain nanocomposite films and CCs, however their growth rates is rather small (0.5-1 nm/s). To address this challenge, we are developing a novel growth approach, entitled Transient Liquid Assisted Growth (TLAG), which is able to combine chemical solution deposition methodologies with ultrahigh growth rates of liquid-mediated approaches (100 nm/s), being compatible with nanocomposite growth and coated conductors. In this presentation, I will revise our recent progress in TLAG-CSD in terms of growth mechanisms, nucleation kinetics, and growth rate, determined by in-situ X-ray imaging (100 nm/frame) under synchrotron radiation. Critical current densities up of 5 MA/cm2 at 77K are already realized in thin films. I will present the new defects landscape and the role of preformed nanoparticles in the vortex pinning of TLAG-CSD nanocomposites. Finally, the approaches followed to grow thick coated conductors will be discussed.

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