Fast production of long-length YBCO coatings by the BaF2 ex situ process using a large-area batch-annealing approach.

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We explore a possible avenue for scaling up of the BaF2 ex situ process by increasing the area of precursor tape processed at once in a confined space. Key parameters controlling the reaction kinetics of BaF2 conversion and YBCO formation in the small-area limit (< 2 cm^2) are: temperature, water partial pressure, gas flow rate, total pressure, thickness, as well as microscopic properties of the precursor layer. With increasing area, however, removal of HF product from the reaction chamber rapidly becomes the dominant factor, effectively extinguishing the conversion rate downstream. A batch furnace with the capacity to hold 6 m of 1-cm wide tape (process area: 600 cm^2) wrapped around a 11-cm diameter spool was designed. As a figure of merit we use the time required for conversion of a long precursor tape relative to the small-area limit, and find that a tape of 6-m length can be homogeneously converted into YBCO by an anneal which is 4 times longer. A fast production rate is thus achieved. Research to further increase the figure of merit is in progress.
Research sponsored by the U.S. Department of Energy under contract DE-AC05-00OR22725 with the Oak Ridge National Laboratory, managed by UT-Battelle, LLC.