particles decrease and the matrix becomes denser. The particle size of the CuO blocks in the initial stage (figure 10(*a*)) is about 10 μm $\times$ 15 mm and is reduced to about 5 μm $\times$ 10 mm in the later stage (figure 10(*b*)). Reduction in the size of the secondary particles is important because it results in a decrease in the barrier to current transport. This is not simply due to an increase in effective cross-sectional area of the HTS but also because Bi-2223 grains tend to bend around large secondary particles resulting in poor local alignment and degradation in J_c. The observation that the J_c value decreases if more than four pressing steps are employed is believed to be due to cracking in the HTS core. This can be verified from the SEM image of a sample that has been subjected to three pressings within 100 h of sintering (figure 11). As shown in the figure, cracks are seen running across the core of the conductor, thereby resulting in lower actual cross-sectional area and apparent J_c.

4. Summary

In an effort to determine the optimum thermomechanical treatment of precursors produced by the aerosol pyrolysis technique, the sintering duration as well as the number of mechanical pressing steps of PIT tapes have been varied systematically. The results show that, as a result of rapid reaction kinetics during the early stages of processing, the initial pressing steps need to be performed between short sintering steps (e.g. 12–25 h depending on the total sintering time and number of pressings). On the other hand, because of the reduced reaction rate, the last sintering interval should be relatively long to enable further Bi-2223 phase conversion and crack healing. In addition, mechanical pressing should not be performed when the Bi-2223 formation has reached about 90% of completion to ensure that liquid phase is available for crack healing. In aerosol precursors, this fraction of Bi-2223 conversion can be achieved in roughly 60 h of heat treatment, whereas hundreds of hours are required for typical commercial powders.

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