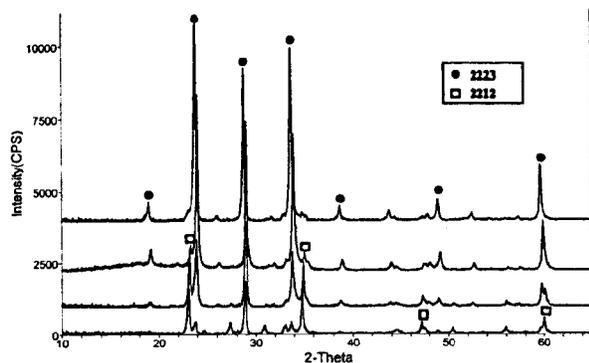
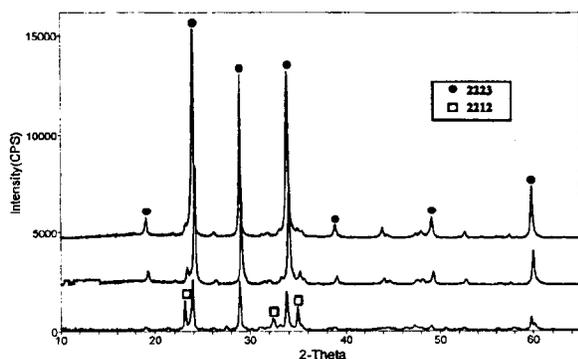


Table 1. Thermomechanical processing sequences indicating sintering duration in hours between each pressing.

Set A	Set B	Set C
Sequence 1: 6–6–12–26–50	Sequence 6: 10–10–10–10–10	Sequence 9: 25–25–50–25
Sequence 2: 12–12–26–50	Sequence 7: 25–25–25–25–25–25	Sequence 10: 25–50–25–25–25
Sequence 3: 24–26–50	Sequence 8: 50–50–50–50–50	
Sequence 4: 50–50		
Sequence 5: 100		

**Figure 2.** XRD patterns of sequence 2 samples at various stages of thermomechanical treatment.**Figure 3.** XRD patterns of sequence 3 samples at various stages of thermomechanical treatment.

3. Results and discussion

3.1. Bi-2223 reaction kinetics

The Bi-2223 phase development of the PIT conductors in the first three sequences of set A is shown as XRD patterns in figures 1–3, respectively. It can be seen from these figures that, as the reaction proceeds, the Bi-2212 peaks disappear while the Bi-2223 peak intensities increase. In addition, the (001) peaks of the Bi-2223 phase become progressively dominant, indicating that *c*-axis alignment of the Bi-2223 grains is improving with processing time and mechanical pressing. It is seen in figure 3 that the Bi-2223 peaks are already prominent only after the first sintering interval, i.e. after 24 h of sintering. This indicates the significance of sintering time on Bi-2223 phase formation even in the presence of retrograde sintering without the benefit of pressing.

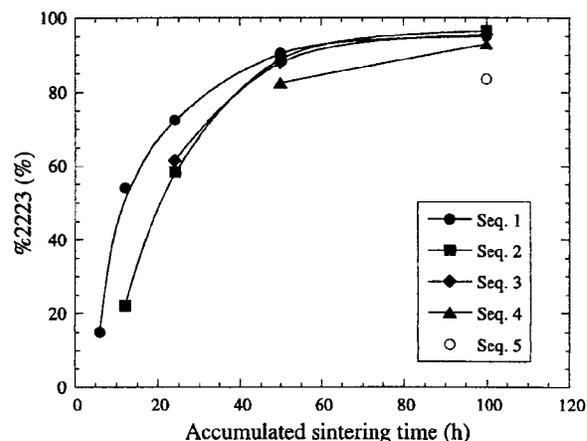
**Figure 4.** Evolution of Bi-2223 phase with sintering time for PIT tapes from experimental set A.

Figure 4 summarizes the phase content results of PIT samples in set A. This figure shows the variation in %2223 with accumulated sintering time of each experimental sequence, and each data point represents a sample at that stage of processing for a given sequence. For example, in the case of sequence 1, the first data point represents the phase content of a sample that has been heat treated for 6 h, the second data point represents a sample that has been treated for 6 h + 6 h, and so forth. It is immediately evident from figure 4 that the amount of the Bi-2223 phase increases with sintering time for all the sequences. Phase conversion is found to be about 90% completed after 60 h of sintering in the first three sequences, and the Bi-2223 content is indistinguishable after this accumulated sintering time. When first pressing was performed after an initial heat treatment of 50 h or more, a longer accumulated sintering time (>60 h) is needed to achieve $\geq 90\%$ Bi-2223 conversion. While deformation history, i.e. when and how many times the tapes were pressed, has minimal effect on the amount of Bi-2223 phase in the final stage of processing, formation of the Bi-2223 phase is facilitated by pressing at the early stages of the treatment schedule. For example, the %2223 value at 12 h of accumulated sintering time of sequence 1 is much higher than that of sequence 2. On the other hand, the amount of 2223 phase is the same for both sequences after 100 h of sintering. This is in agreement with previous reports [3, 9] on the importance of pressing during initial stages of heat treatment so as to counteract the effect of retrograde sintering and to bring the unreacted precursor particles into intimate contact. Bi-2223 phase content results from set B are consistent with the above observation and are shown in figure 5.