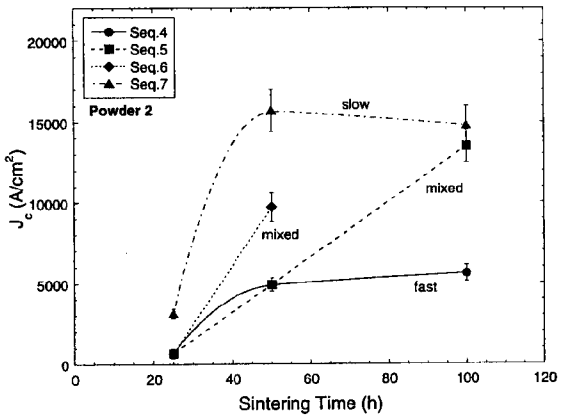

Figure 7. Variation in J_c with accumulated sintering time for PIT tapes containing powder 2 and subjected to treatments listed in experimental set B.

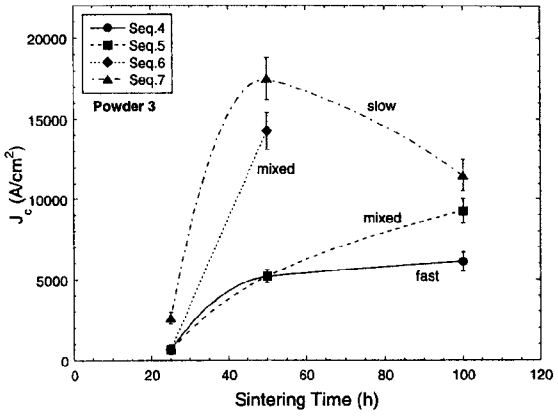

Figure 8. Variation in J_c with accumulated sintering time for PIT tapes containing powder 3 and subjected to treatments listed in experimental set B.

however, cannot account for the significant enhancement in J_c. For instance, based on samples in sequence 4, PIT conductors in sequence 6 should only possess J_c values of approximately 5000 A cm^{-2} after 54 h of sintering (50 h accumulated time at 825 °C plus one 4 h duration above 800 °C during final slow cooling) instead of the much higher 10 000 A cm^{-2} value. Besides the general observation that J_c is enhanced by slow cooling, samples in sequence 5 (mixed) where slow cooling was only carried out after 100 h of accumulated sintering attained a J_c as high as those that were subjected to slow cooling at every sintering step (sequence 7, slow). This indicates that it may be sufficient to performed one single final slow-cooling treatment to enhance the J_c if the total sintering time is maintained at long lengths. On the other hand, if slow cooling can be performed at every sintering step, savings in accumulated processing time are possible: 50 h of sintering plus 40 h of two slow-cooling steps for sequence 7 versus 100 h of sintering plus 20 h of slow cooling with additional time consumed by one heat-up/cool-down cycle and extra mechanical work for sequence 5. When an inadequate amount of sintering was performed, samples subjected only to a final slow-cooling treatment (sequence 6, mixed) possess J_c values lower than those of fully processed and slow-cooled PIT, but are still significantly higher than conductors that have been subjected to purely fast-cooling treatments.

Changes in J_c with accumulated sintering time for powder 3 PIT conductors that were subjected to processing sequences in set B are shown in figure 8. The J_c characteristics of these tapes are essentially the same as those containing powder 2 and subjected to the identical heat treatments (figure 7). One noticeable difference is seen in samples for which slow-cooling treatment was performed after every sintering step (sequence 7); J_c of powder 3 samples are found to have decreased dramatically after two pressings and three sintering steps followed by slow cooling whereas those of the companion powder 2 samples are only slightly reduced. Also, the improvement in J_c is relatively small for the tapes treated for 100 h with a final slow-cooling step whereas those treated for 50 h revealed

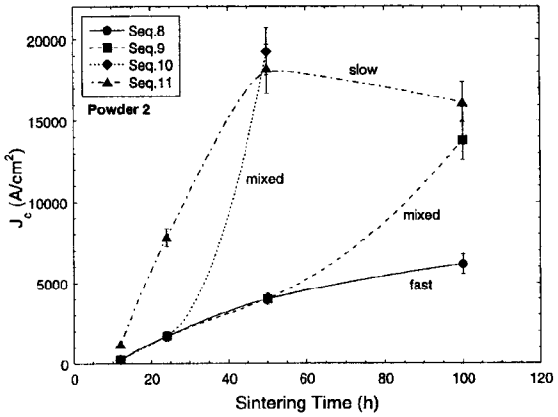

Figure 9. Variation in J_c with accumulated sintering time for PIT tapes containing powder 2 and subjected to treatments listed in experimental set C.

significant J_c enhancement. These results all indicate that the reaction kinetics of PIT containing powder 3 is faster. Consequently, further mechanical pressing after 50 h will result in cracks where the beneficial effect of slow cooling is either reduced (sequence 5) or nullified (sequence 7).

Similar J_c behaviours can also be seen in figure 9 which shows the variations in J_c of powder 2 PIT tapes processed by the experimental sequences in set C, i.e., earlier and more frequent mechanical pressings. Whether the samples are subjected to slow cooling after every sintering step or only during the final treatment, it can be seen from the figure that the J_c are identical following 100 h of accumulated sintering. More interestingly, the highest J_c values of approximately 20 000 A cm^{-2} are obtained after 50 h of heat treatment in samples subjected to slow cooling after every sintering interval or only during final cooling after the 50th hour (sequence 10). When compared to the J_c characteristics exhibited in figure 7, the peak behaviour indicates the beneficial effect of pressing and densification on the fast-reacting precursors during early stages of processing. Consequently, when early pressing is employed, it is only necessary to heat treat the PIT conductors for an accumulated time of 50 h with slow cooling during the final step, which represents significant