Discussion

On the basis of the preceding results, it can be concluded that in the as-quenched condition, the L-J phase was present in the $Cu_{3-x}Mn_xAl$ alloys with X=0.2, 0.3 and 0.4, whose amounts increased with increasing manganese content. Besides, the $\beta \rightarrow B2 \rightarrow D0_3+L2_1$ transition had occurred during quenching in the $Cu_{2.6}Mn_{0.4}Al$ alloy. These observations are consistent with those proposed by Bouchard et al. [1]. However, when the $Cu_{3-x}Mn_xAl$ alloys with X=0.1, 0.2 or 0.3 were solution heat-treated followed by a rapid quench, the $\beta \rightarrow B2 \rightarrow D0_3$ transition instead of the $\beta \rightarrow B2 \rightarrow D0_3+L2_1$ transition was found to occur. This finding is different from the previous proposition in the $Cu_{3-x}Mn_xAl$ alloys with $0.1 \leqq X \leqq 0.8$ [1].

In the Cu-Al, Cu-Al-Mn, Fe-Al and Fe-Al-Mn alloys [34-38], it is well-known that if the $D0_3$ phase was formed by continuous ordering transition during quenching, it would

occurred through an A2 (disordered body-centered cubic)→B2 →$D0_3$ transition. The A2→B2 transition produced the a/4<111> APBs and the B2→$D0_3$ transition produced the a/2<100> APBs [34-37]. However, to date, no a/4<111> APBs could be investigated by other workers in the Cu-Al-Mn alloys [1-28, 38]. In the present study, it is indeed found that no evidence of the a/4<111> APBs could be observed in the alloy D, which the manganese content is X=0.4. However, when the manganese content was decreased to X=0.3 or below, the a/4<111> APBs became visible, as shown in Figure 6(d). This result implies that in the Cu-Al-Mn alloys, an increase of the manganese content would increase the B2 domain size significantly. This may be one possible reason to account for the absence of the a/4<111> APBs in the previous studies of the as-quenched $Cu_{3-x}Mn_xAl$ alloys with $0.5 \leqq X \leqq 1.0$ [1-2, 25].

Finally, by comparing Figures 5 and 6, three important experimental results are given below:

(Ⅰ) When the manganese content increased to above 10.0 at.% (X=0.4), the B2 domain size would consume the whole grain during quenching. Therefore, no a/4<111> APBs could be detected.

(Ⅱ) The size of the $D0_3$ domains increased with increasing the manganese content. This implies that an increase of manganese content would increase the B2→$D0_3$ ordering transition temperature. This result is comparable to that obtained by Bouchard et al. [1].

(Ⅲ) The amount of the extremely fine L-J precipitates was increased with increasing the manganese content. Correspondingly, the intensity of the reflection spots and streaks of the L-J precipitates was also increased with increasing the manganese content.