7. RECOMMENDATIONS FOR FUTURE WORK

The preparation of Al-Ti-B grain refiners by aluminothermic reduction of TiO_2 and B_2O_3 is demonstrably possible. The real issue seems to be the performance of the products prepared by this route compared to commercial grain refiners. The grain refiners characterized in this work were prepared in two steps: the aluminothermic reduction of the two oxides which yielded an aluminium-base alloy with high titanium and boron contents, followed by the dilution of this alloy to bring the content of titanium and boron to the level met in commercial grain refiners. The first step led to the formation of TiB_2 particles and $TiAl_3$ particles in an aluminium matrix. The second step did not affect the TiB_2 particles, which were of great importance in imparting grain refining efficiency to the master alloys. Once they were formed nothing could be done to change them either in size or in morphology.

Therefore, the sequence of addition of feed materials seems of great importance in the preparation of the grain refiners. Reacting simultaneously TiO_2 and B_2O_3 with molten aluminium in the preparation of grain refiners analyzed here led to coarse TiB_2 due to the fact that all the boron reacted with the titanium available, with the titanium-to-boron ratio being far above the stochiometric level of 2.22 for the formation of TiB_2. In order to get fine TiB_2 in the aluminium matrix, other feeding methods could be investigated. It is suggested that the feed materials be added in the following sequences:

-Addition of TiO_2 to molten aluminium to produce Al-Ti alloy with low titanium content and melting of this alloy in the presence of B_2O_3.

-Addition of B_2O_3 to molten aluminium, followed by the addition of TiO_2.

-Feeding of the two oxides from bottom and top of the bath respectively.

In addition to criteria defined to characterise the experimental grain refiners in this work, other technical criteria such as the cleanliness of the inoculated metal could have been included. These criteria directly linked to cast house practice and important for viable commercial application include factors such as the form of the grain refiner, the inclusion introduced in the inoculated metal and the effects on the boride-sensitive applications such as thin foil, can stock and surface critical profile.