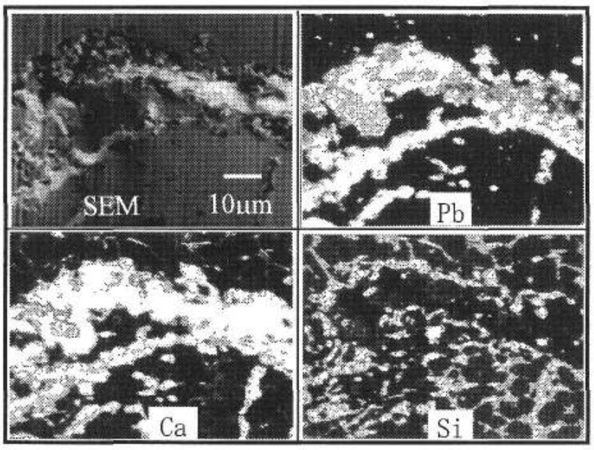
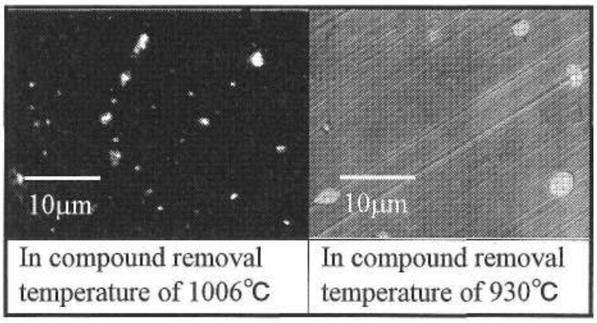


Fig.3. EPMA analysis of the skimmed compound.

Figure 4 shows SEM images of the microstructures of ingots. At a compound removal temperature of 930°C, Ca-Pb compounds of several µ m in diameter are observed. At 1006°C, fine-grained Ca-Pb compounds of nearly 1µm in diameter are dispersed. The grain size of these compounds is similar to that of Pb in as-received brass. This suggests that fine-grained Ca-Pb compounds are formed by in situ reaction. When the compound removal temperature is higher than the melting point of Ca-Si compound, added Ca-Si compound liquefies. Fine–grained Ca-Pb compounds, which are formed by in situ reaction, do not float to the surface of the molten metal, resulting in a low percentage of Pb removal.



In compound removal temperature of 1006°C

In compound removal temperature of 930°C

Fig.4. SEM images of the microstructures of ingots.

Figure 5(a) shows the relationship between the percentage of Pb removal and grain size of Ca-Si compound. The percentage of Pb removal increases with an increase in grain size of Ca-Si compound. This is because the grain size of Ca-Pb-Si compound increases with that of Ca-Si compound, activating the rise of the Ca-Pb-Si compound to the surface of the molten metal.

Figure 5(b) shows the relationship between the percentage of Pb removal and the method of adding Ca-Si compound. The percentage of Pb removal decreases with an increase in the number of additions of Ca-Si compound. This suggests that most of the Ca-Pb-Si reaction occurs during the first addition of Ca-Si compound and the contribution of subsequent additions of Ca-Si compound is relatively insignificant.

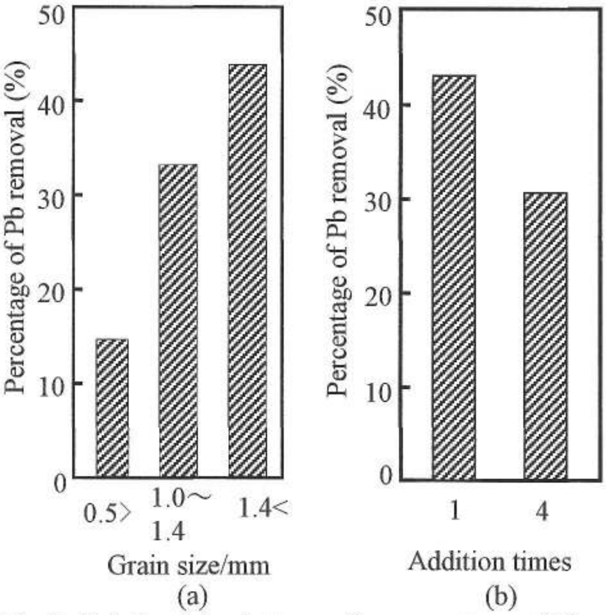


Fig.5. Relationships between the percentage of Pb removal and (a) grain size of Ca-Si compound and (b) the number of additions.

Figure 6 shows the relationship between the percentage of Pb removal and agitation time. The percentage of Pb removal reaches a maximum value at 6 minutes, and decreases with a further increase in agitation time. The increase in the percentage of Pb removal at the early stage may be caused by an increase in opportunity for contact between Ca-Si compound and Pb. However, with further agitation after formation of Ca-Pb-Si compounds, it is likely that small Ca-Pb compound particles separate from