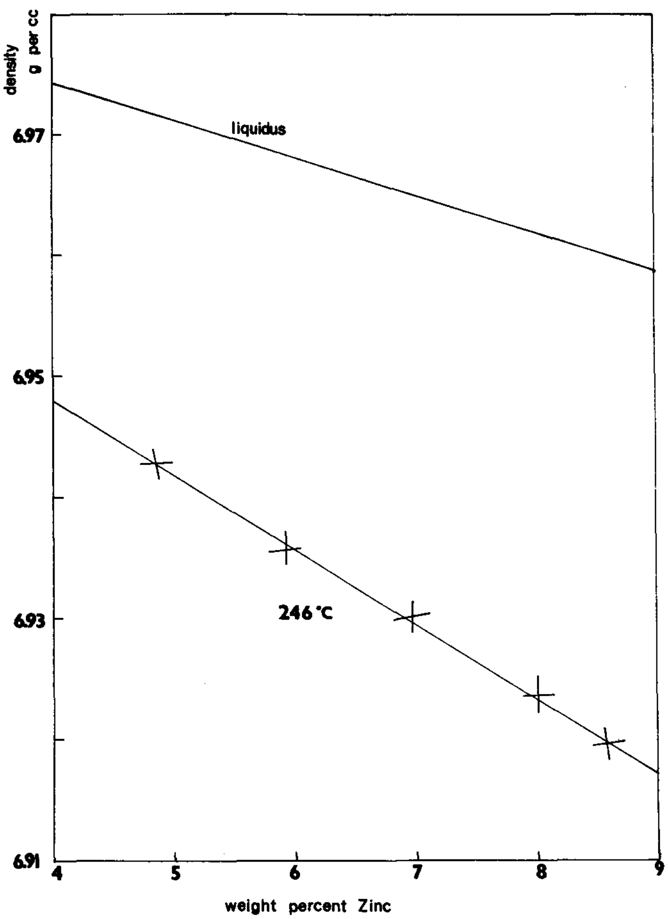

Fig. 4—Density composition plots for zinc and tin alloys, at 246°C and at their liquidus temperatures.

alloy in the syringe was 7.5 wt pct Zn, which is the composition midway between the overall alloy composition and the ZnSn eutectic. The tracer alloy was injected when the tip of the syringe had just reached the 7.5 wt pct liquidus temperature, corresponding to about 25 pct weight solid at that point in the casting.

A typical macrostructure of a specimen, which was quenched during growth, is shown in Fig. 2. The figure shows the shape and form of the eutectic and dendritic fronts during the freezing process. Samples were cooled at different rates by changing the air cooling pressure. The autoradiographs for the different cooling rates are shown in Fig. 3. These samples were not quenched during growth. The motion of the radioactive material can clearly be seen, as can the dependence of flow on the time before onset of the eutectic front. There was an indication that radioactive liquid had reached the bulk liquid in the sample which was cooled slowest.

The density of the Zn-Sn alloys were measured against composition at constant temperature, and against temperature at constant composition using conventional specific gravity bottles. The results extrapolated to the liquidus are shown in Fig. 4. The temperature coefficient of the density was measured to be 8.487×10^{-4} g/cu cm/deg C.

DISCUSSION

From the autoradiographs, Fig. 3, it can be seen that gravitational fluid flow occurs and that the direction of motion is in part upwards in the partially solid region. This is the direction to be expected from the density measurements. It should be noted that flow in most other alloy systems, where the densities of the component materials are very different, would be expected to be more pronounced than the flow found in these experiments. The density of pure tin (6.84 g/cu cm at 420°C)[6] is almost identical to that of pure zinc (6.66 g/cu cm at 420°C)[6]. So that little change in density is to be expected with change in composition in this alloy.

The autoradiographs, Fig. 3, also show that there is some flow within the partially solid region toward the eutectic interface, as is to be expected due to the volume contraction as the remaining liquid freezes.[7]

Concurrent experiments on macrosegregation[5] indicate that the macrosegregation in these alloys is that expected from the gravitational fluid motion.

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Fig. 10 and Fig. 12, Pages 1590 and 1591

Figs. 10 and 12 should be interchanged. The captions, as published, are correct.