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A Method for Laboratory Scale Melting and Solidification Studies of Cast Irons

Most studies on the melting and solidification of cast irons have involved the use of large scale melting operations. In studies that examine the effect of impurities on solidification behaviour two major difficulties are encountered. These are the difficulty of making additions to the iron, and the low yields of such additions.

A technique has been developed whereby these difficulties are largely overcome and the present communication describes this method in which accurately weighed, compacted powder samples are rapidly melted in an induction coil. The technique involves the use of high purity metal powders (electrolytic iron, spectroscopic grade graphite, and high purity silicon) which are weighed and thoroughly mixed. The resulting powder mixture is compacted to form a cylinder 1 cm in diameter under a pressure of approximately 25000 psi.

The compacted sample is placed under an inert atmosphere in an alumina crucible situated in a graphite susceptor and the whole assembly positioned in a high frequency (400 kHz) induction coil.

Temperature measurements are recorded continuously during melting and freezing using a thermocouple located at the base of the sample. Considerable alloying occurs in the solid state before fusion as the recorded melting tempera-

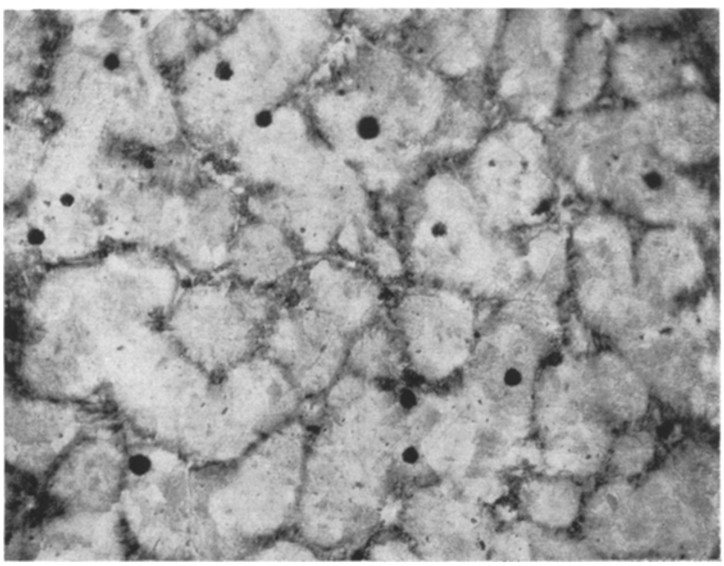

Figure 1 (a) Microstructure of an alloy of Fe-3% C-2% Si showing graphite present as nodules. Nital etch (× 200).

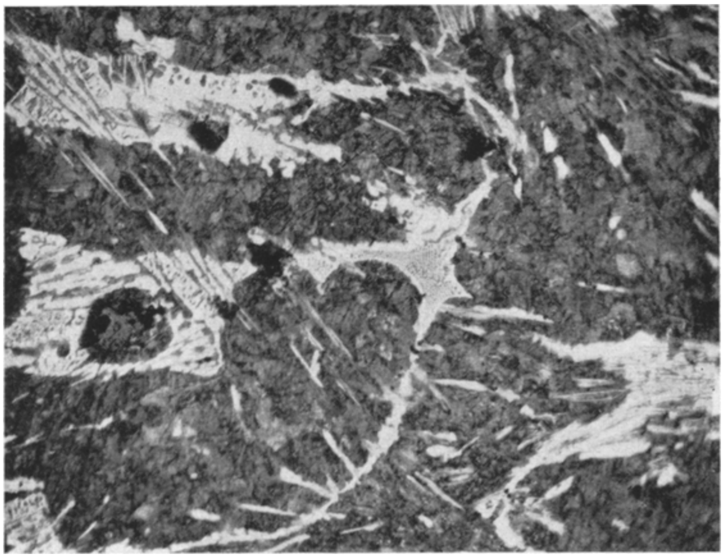

Figure 1 (b) Microstructure of an alloy of Fe-3% C-2% Si-0.03% S. Nital etch (× 200).

tures are close to those expected for the alloys used. Thus, the problems of the introduction of elements into liquid iron baths are overcome.

It is well established that graphite morphology is affected by the presence of impurity elements, and at present the technique is being used to study the effect of impurity elements on the graphite morphology of hypo-eutectic cast irons.

Figs. 1a and 1b show the results of some preliminary experiments on the effect of sulphur on graphite morphology. Fig. 1a shows the structure obtained on melting a sample prepared from very pure iron, 3% C and 2% Si. The graphite is here present as nodules. The addition of 0.03% sulphur leads to a tendency to form the Fe-Fe_3 C eutectic and changes the morphology of any graphite which may be present as seen in fig. 1b.

In summary, there are several advantages of this powder technique over more conventional methods of melting on a laboratory scale.

(i) versatility – any system whose components can be prepared as powders can be studied, e.g. Fe-C-Si, Al-Si, Cu-Zn.

(ii) high purity materials may be used.

(iii) speed – the time required for the Fe-C-Si samples from powder to solidified specimen is only 15 min.

(iv) stricter control of composition.

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Evidence for AC and DC Electroluminescence of CdS : Cu Powder Phosphors

Electroluminescent (EL) CdS powder phosphors have not been produced before [1], though chemically similar ZnS powder has been a well-known electroluminophor for more than thirty years. In fact, as has been shown [2], even (Zn, Cd)S powder, produced by the usual methods for preparing EL ZnS powders, ceases to exhibit EL when containing more than 50 g