Chlorination of Chromite

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THE use of chlorine for working up of complex and low grade ores in order to extract metals has been engaging the attention of metallurgists for a long time. A number of earlier workers have done useful work in this direction, and a critical review on the use of chlorine in metallurgy has been given by Kroll[1]. Chlorination is also proposed for the beneficiation of substandard ores. India possesses abundant resources of low grade chromite which do not satisfy the requirements for use in the production of ferrochromium, chromium chemicals, etc. The chlorination of low grade chromite has some specific advantages in chemically disintegrating the spinel structure and beneficiating the ore to yield a saleable product. Production of pure chromium chloride itself and its subsequent treatment for extracting the pure metal has been investigated by Maier[2] and Goltz *et. al.*[3] This short note gives the results of some preliminary investigations on chlorination of a typical Indian chromite ore with special reference to easy production of briquettes suitable for chlorination.

The chromite used in these experiments was from Mysore and its main constituents were; Cr_2O_3 — 43%; FeO — 19%; Al_2O_3 — 15%; and MgO — 10%. The size of the ore used was — 100 mesh.

The charge was chlorinated in a special porcelain tube heated externally by nichrome wire. Temperature was varied by changing the current passing through the resistor. Chlorine was drawn from a cylinder through a flow meter. The connectors were made of graphite.

Chlorination of ore involves the use of some reactive carbonaceous material along with a binder usually included in the form of tar, pitch, molasses, etc. The ore-carbon mixture is to be charged in the form of briquettes which should have sufficient strength to resist breakdown during handling and be porous enough to maintain a high rate of reaction. In these preliminary experiments, molasses and tar were the binders used. For the preparation of briquettes using molassess as the binder, the paste of ore, carbon and molasses was pressed in a hand operated screw press, cut into small pieces, dried in an air-oven at 120°C, and heated to 300-400°C, in a current of nitrogen. When tar was used as the binder, the method of preparation of briquettes was the one used by McTaggart[4] for chlorination of rutile. The latter method was quite simple involving no special equipment and produces briquettes of satisfactory quality. The method consisted in mixing the ore with powdered coal or coke and crude tar (sp. gr. not more than 1.1) to give a thick pasty mass. This mass was then spread out on an iron tray to make a layer of 0.5 to 0.75 in thickness. The tray was then heated strongly by means of fire underneath, and when gases were evolved from the pasty mass, they were set alight also. Fierce burning from the surface continued for about half an hour and then subsided. The fire underneath was put out and the mass was cooled. The tray then contained a layer of porous coke like material, hard enough to withstand handling. It was broken into suitably sized lumps and heated out of contact with air to about 600°C to drive off the remainder of the volatile material, and the mixture was now ready for chlorination.

The results of the representative chlorination experiments are presented graphically in figures 1, 2 and 3.

The attack on chromite by chlorine increases with increaing amounts of carbon and the reaction rate becomes appreciable even at lower temperatures. A high percentage of coke, pitch and tar on the lines suggested by Pokorny[5] is found to result in a marked increase in yield.

REFERENCES

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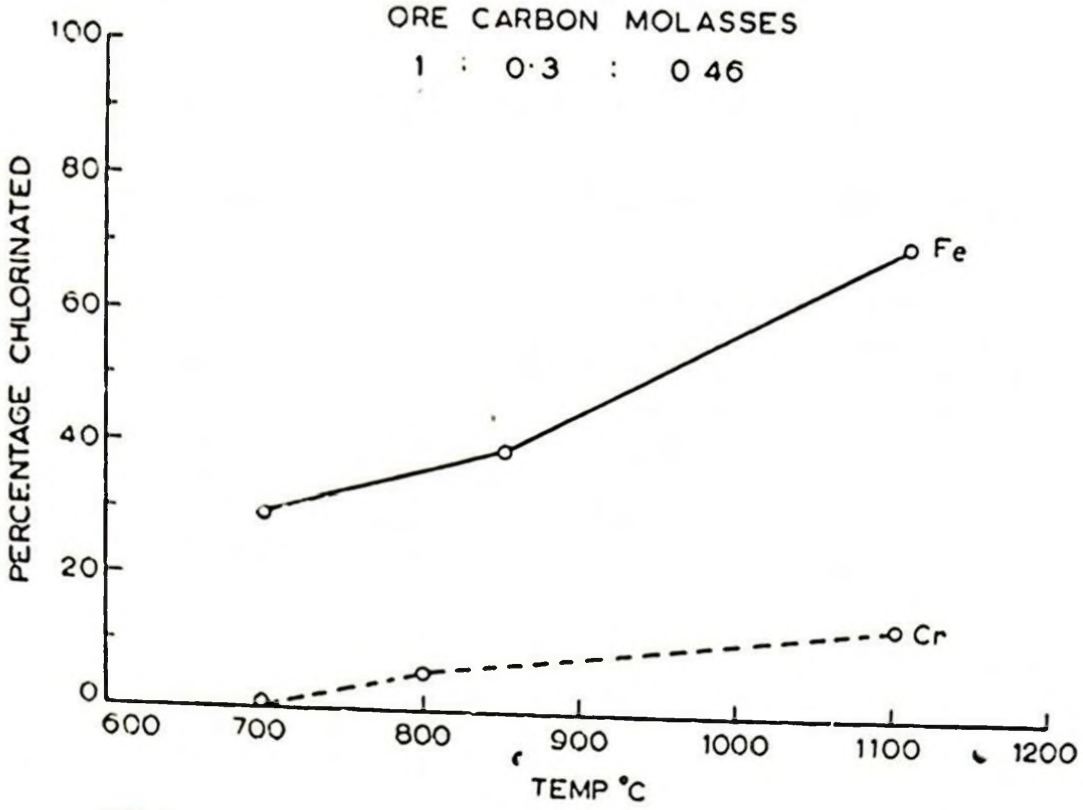

ORE CARBON MOLASSES
1 : 0·3 : 0 46
PERCENTAGE CHLORINATED
100
80
60
40
20
0
Fe
Cr
600
700
800
900
1000
1100
1200
TEMP °C

FIG 1

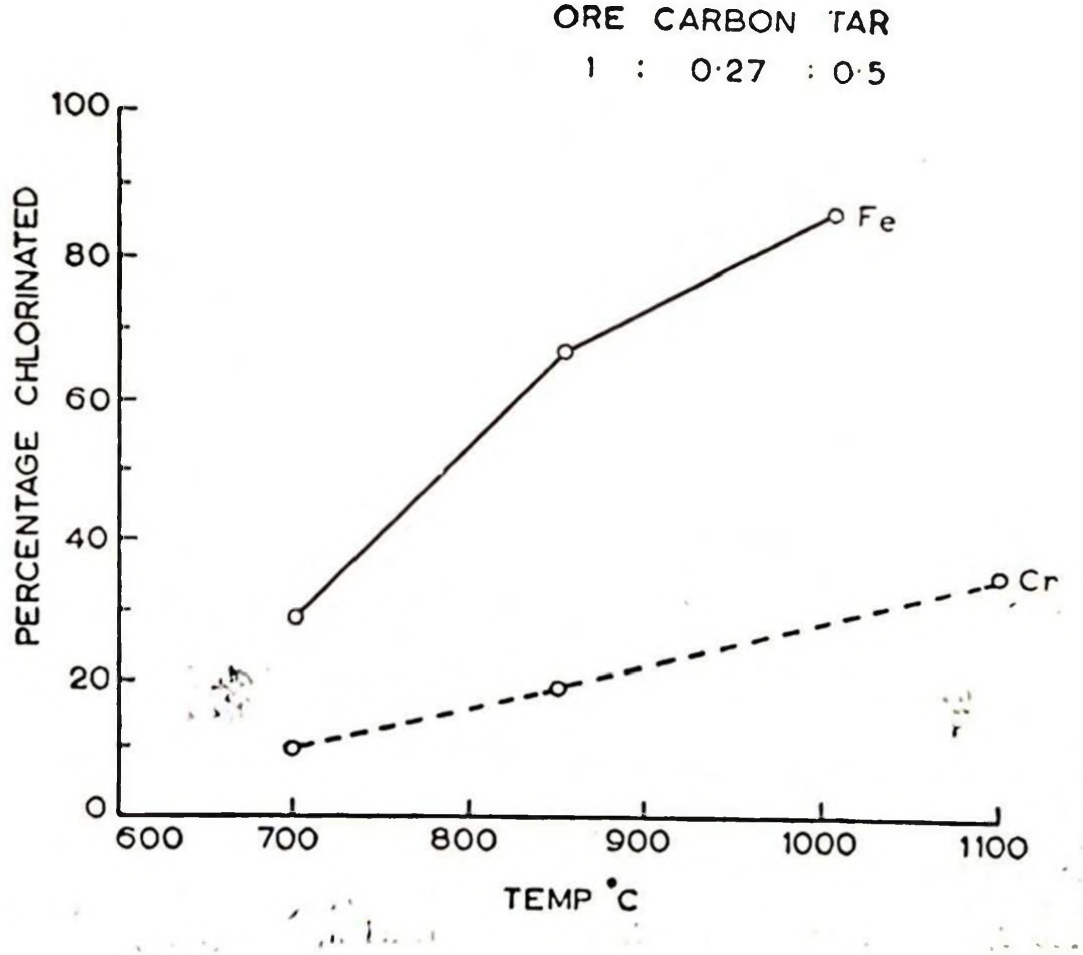

ORE CARBON TAR
1 : 0·27 : 0·5
PERCENTAGE CHLORINATED
100
80
60
40
20
0
Fe
Cr
600
700
800
900
1000
1100
TEMP °C

FIG. 2.

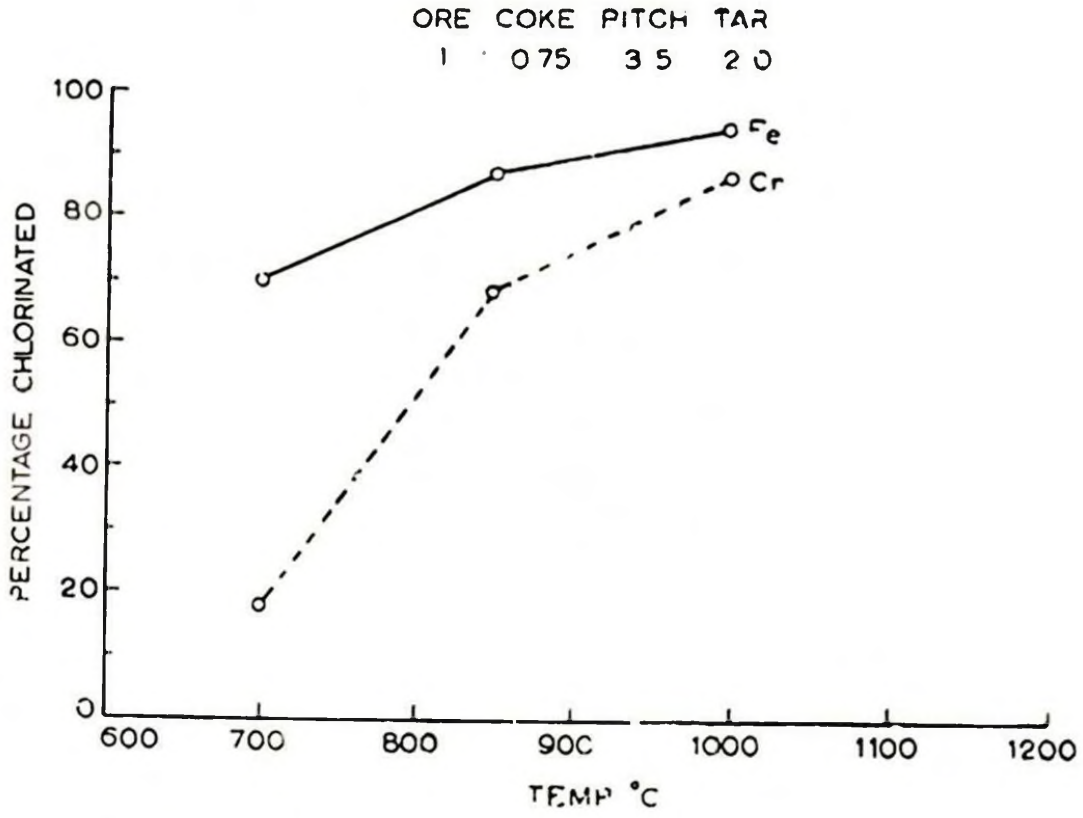

ORE COKE PITCH TAR
1 0.75 3.5 2.0
100
80
60
40
20
0
PERCENTAGE CHLORINATED
Fe
Cr
600
700
800
900
1000
1100
1200
TEMP °C

FIG 3.