RAW MATERIALS
2.1 INTRODUCTION:

In consideration of the changing pattern of demand for various applications in the modernised facilities for iron and steel making, there is an inescapable trend of utilising raw materials of relatively superior grades both in terms of chemical purity and physical characteristics. The importance of basic refractories has increased considerably over the years due to rapid expansion of the iron, steel and cement industries. The increase in production has increased the demand for magnesite in the manufacture of magnesia, mag-chrome and magnesia-carbon refractories required in BOF furnaces for steel making. The major source of these important magnesite refractories are generally derived from natural ore or from synthetically processed sea water magnesia. For use as a refractory material whether natural or derived from the seawater, magnesia has to be dead burnt so that the material becomes volume stable and does not chemically absorb water/CO₂ at subsequent stages. The process is accompanied by a chemical change of material from magnesite (sp. gr. 2.94-3.02) to periclase (sp. gr. 3.58).

Magnesium carbonate still remains the most significant source of magnesia worldwide and in India, two major occurrences of the mineral are found in the Himalayan and Southern regions. Reserves in India have been estimated at 222 million tons. Major deposits occur in Himachal Pradesh, Karnataka, Rajasthan, Tamil Nadu and Uttar Pradesh (TABLE 2.1).

TABLE-2.1
Magnesite Ore Reserves:

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Region — Kumaon Hills of U P</td>
<td>69%</td>
</tr>
<tr>
<td>Southern Region — Tamil Nadu</td>
<td>29%</td>
</tr>
<tr>
<td>Other Regions — J&amp;K, Karnataka, H P, Kerala, Rajasthan</td>
<td>2%</td>
</tr>
<tr>
<td>Total estimated reserve</td>
<td>222 million tons</td>
</tr>
</tbody>
</table>
In Karnataka the deposits are in the Mysore district and to a lesser extent in Hassan district and in U P, magnesite is found in the Almora, Pithoragarh and Chamoli districts [1]. The present study is concentrated on Salem and Almora magnesite from Tamil Nadu and Uttar Pradesh respectively.

2.2 PRIMARY STARTING MATERIALS:

2.2.1 SALEM MAGNESITE [S0]

In Salem, magnesites occur as veins and lenses in ultrabasic rocks of the Chalk Hill in Tamil Nadu and this occurs in two areas— one to the north and other to the south; two are separated by a band of biotite-hornblende gneiss which is the oldest rock formation of this area. The ultrabasic rocks were affected by super heated CO₂ and H₂O generated at great depth and mag-silicates were altered to MgCO₃ releasing silica during the process. So the instrument of alteration of ultrabasic rocks is of deep seated magmatic origin [2]. Analyses of 140 samples from this area shows— MgO = 92%, CaO = 1.68%, SiO₂ = 3.78%, R₂O₉ = 1.84% (on loss free basis). Silica is the major impurity which is present as quartz veins or lenses within magnesites (Supplied by Burn Standard Ltd., Salem). Magnesite occurs as an enechelon lenses over 3.5 km length; each lens measuring 120-750 m. in length and 40 m. in width [2]. Geological exploration suggests that the magnesite veins, by and large, do not persist beyond 50m. depth from present ground. The close association of serpentine and quartz shows up as variable silica content in chemical analysis. In Salem deposits with rising silica content, DBM is likely to contain MgO of 89% and silica between 6-8%.

2.2.2 ALMORA MAGNESITE [A0]

A chain of lenticular deposits extend for a total length of about 130 km from Alokanda Valley in Chamoli district.
to Kali River in Pithoragarh district. An estimated reserve of 6.7 million tons of magnesite have been inferred in this area. In Almora dt., 12.87 million tons of reserves have been reported. Here, magnesite is associated with dolomite and talc. So magnesite of this region have been formed by the hydrothermal action on dolomitic limestone. Iron oxide, as siderite is present as solid solution with magnesites which is the major impurity in Almora magnesite. The coarse magnesite deposits therefore assay low MgO (usually 42.5—44%), high calcium (01%), high iron (2—4%) and variable silica (Supplied by Almora Magnesite Ltd., U P.)

2.2.3 SILICA BIOLEACHED SALEM MAGNESITE : [U0]

The upgradation of natural magnesites have been attempted by many workers [3,4] who have generally followed two major methods. The first is the beneficiation through impurity separation while the second is the addition of dopant or mineraliser to enhance sintering, grain growth and resultant properties. The inherent ability of natural magnesite to produce large grain size is a major advantage which can be coupled with addition of transition metal ions to enhance further grain growth [5]. This provides the basis for research and development as there is a necessity for industrial development to work with indigenous impure raw magnesite for further refractory applications. In the present study both methods, viz. beneficiation and mineraliser addition have been attempted to improve the character of natural magnesite during sintering. A cryptocrystalline Salem magnesite of Tamil Nadu region (Supplied by Bose Institute, Calcutta, India), was chosen as one of the control materials for the present study (U0). The major impurity in this magnesite is silica which is present as thin vein and stringers. Mishra et al [6] leached out these silica veins by microbacterial techniques using a silica leaching bacteria. The mechanism of solubilising these impurities is not clear. It is reported that gram positive strains were effective for leaching
of silica from Salem magnesite. A sample of this leached magnesite formed the second material and has been termed as Treated Salem magnesite (TO).

2.3 MINERALISERS:

2.3.1 TITANIA:

TiO₂ occurs in three distinct crystallographic forms, rutile, anatase and brookite which present an example of trimorphism all having the same chemical composition. It crystallises in tetragonal system. The average particle size of titania in anatase form used here was about 0.4 μm and the chemical purity was about 99.9%. The physical appearance was as a fine white powder.

2.3.2 ZIRCONIA:

Baddeleyite (ZrO₂) is another starting material which crystallises in monoclinic form. The average particle size was about 5 μm, white powder in appearance, with a chemical purity of about 99.5%.

2.3.3 ILMENITE:

Ilmenite (FeTiO₃) is one of the chief minerals of titanium. Theoretically it contains 52.6% TiO₂ and 47.4% FeO. This is found in basic igneous rocks. In the present case it was collected from Kishengarh area of Bihar district. The mineral was iron black in colour. The average particle size of the powder used was about 9 μm.
2.4 REFERENCES:


2. Sondhi, V. P., Magnesite; Records of the G. S. I., vol. 80, 426-437 (1954).

