Chapter Two

OBJECTIVE
2. Objective

The present investigation has been specially aimed at the development of a superior advance matrix basic refractory castable composition selecting fused magnesia/dead burnt sea water magnesia as aggregate and non-conventional aluminum oxy chloride as binder during minor addition of sol-gel derived two different spinel precursors. The effort is supposed to enhance the self-flow properties of the castables mixes for its easy fabrication into monolithics, favour ease of drying, arrest the strength retrogressions property of conventional cement based basic castable in the intermediate temperature range 500°C-1000°C and finally assist in sintering of castable at a relatively low temperature.

For this purpose, two different types of commercially available dead burnt magnesia such as fused natural magnesite and dead burnt sea water magnesia were chosen, ground and fractionated into three different size fractions such as coarse, medium and fine. Basic Al-oxychloride was synthetically prepared by interaction of aluminum hydroxide and concentrated hydrochloric acid at pH 4.0. Double hydroxides hydrogel of MgAl$_2$O$_4$ and MgCr$_2$O$_4$ were prepared via co-precipitation route from aqueous phase interaction of respective salt solutions with basic medium. Batch compositions of the basic castable body were accomplished by using uniformly blended different size fractions of each magnesia as aggregate on the basis of the Andreassen equation$^{15}$ by maintaining n value at 0.25 with 3%-6% (w/w) aluminum oxy-chloride binder in presence of minor addition of respective binary spinel precursor and 4.5% portable water. Bars and cubes are fabricated by vibro-casting method for each of the batches. The prepared samples are cured at 110°C and fired at different temperatures ranging from 550-1550°C. The cured and fired castable samples are examined by the measurement of different physical properties such as linear shrinkage on firing (LS), bulk density (BD), apparent porosity (AP), compressive strength (CCS), cold modulus of rupture (CMOR), Vickers micro hardness, co-efficient of linear thermal expansion, thermal shock resistance and slag corrosion resistance. The identification of crystalline phases and micro structural features of sintered MgO based basic castable are ascertained by X-ray diffraction (XRD) and scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS) studies respectively.
Finally, different physical properties of aluminum oxy-chloride bonded fused and dead burnt sea water magnesia based basic castables fired at different temperatures in presence of minor proportion of individual additive are compared, correlated and optimized. The corresponding derived crystallographic phases and microstructural features of sintered basic castable bodies will be further analysed and correlated with above thermo-mechanical, corrosion resistant properties for tailoring of the best composition for the superior basic refractory castable in relation to the nature of dopant, its dosage and sintering temperature.