1 INTRODUCTION:

The value of an iron ore depends on mineralogical form in which it is present. It also depends on the chemical composition and type of gangue material present[1]. The ores are charged to the reactor as raw or agglomerated into pellet or sinter before charging ~~for advantage~~. Today, the increasing trend is towards use of pellets, in conventional iron-making and direct reduction process[2], ~~which is known~~. The ore is heated during induration of agglomerate and the physical or physico-chemical properties of agglomerate depend on the phase and mineralogical changes that occur on heating of the ore[3-6] The decomposition of associated minerals and gàngue materials, oxidation of decomposition product, melt formation and other processes affects the pore formation[7], resultant porosity and pore structure of pellets[8] which has enormous effect on mechanical properties and reducibility of pellets. The porosity and pore structure affects the compressive strength [6,9] and thermal conductivity [10] of pellets It also plays an important role in controlling its high temperature properties[11] and swelling index[12,13] which is an undesirable phenomena during reduction of iron ores. These aspects require a complete characterisation of iron ore to understand its behaviour during agglomeration.

On the other hand, the knowledge of thermal properties of pellet is essential to analyse the heat transfer process during iron making[14]. The importance of thermal conductivity was examined by Wynnycky and Mc-Curdy[15] for induration of pellets. They report that three-fold increase in thermal conductivity of pellet resulted in a ten-fold increase in their propensity to develop shrinkage cracks. The role of thermal properties and heat transfer on the reaction kinetics of magnetite-coal char composite pellets was emphasised by Seaton and Co-workers.[16] Akiyama et al[14] simulated the heat transfer in drying of non fired pellets, containing combined water in moving bed reactors.

In view of the above, in the present work, an attempt has been made to characterise the iron ore procured from Rajhara mines for its decomposition of minerals and gangue, decomposition kinetics, mineralogical changes that occur on heating, reactions and melt formation etc by using thermal analysis and x-ray diffraction. Subsequently the average thermal conductivity of pellets made from this ore, for radial heat transfer was determined by measuring the temperature at surface and centre of a heating pellet and applying the principle of heat balance and co-related it to porosity. Available model equations on densification and sintering were used to interpret the results. Experiments were conducted with pelletized pellet, low porosity pressed pellets and with hand rolled synthesised iron oxide pellets.

The thermal analysis data were also used to evaluate quantitative phase analysis, activation energy and order of reaction by application of non-isothermal kinetic equations.