

Upgrading of Sri Lankan Ilmenite by Ball Milling Induced Carbothermic Reduction

T.D.U. Wijewardhana and A.S. Ratnayake

Department of Science and Technology, Uva Wellassa University, Badulla, Sri Lanka

Ilmenite (FeTiO_3) and rutile (TiO_2) are titanium bearing heavy minerals. The existence of ilmenite percentage (70-72%) is much higher than rutile percentage (8%) in the northeastern coastal area of Sri Lanka. The value of rutile is higher than ilmenite. Though there are many chemical methods for upgrading ilmenite, physical method is cost effective for Sri Lanka. This research was carried out to analyze the optimum temperature under specific conditions for upgrading ilmenite using physical method. Upgrading was carried out using magnetically separated ilmenite sample from Lanka Mineral Sands, Pulmoddai. Mixture of ilmenite and activated carbon samples were milled using planetary ball mill for one to four hour separately. Subsequently milled samples were treated with activated carbon and heated for two hours at temperature of 800 °C, 900 °C, 1000 °C, 1100 °C and 1200 °C. Crystallinity and functional groups of the treated samples were determined using X-ray diffractometer (XRD) and Fourier transform infrared (FTIR), respectively. Particle sizes of the treated samples were determined using dry sieving method. Intensity, broadness and number of titanium dioxide (TiO_2) XRD peaks in treated samples were increased with the time during the studied four hours. FTIR analysis indicates initial ilmenite contains Fe=O, Fe-O and Fe-OH stretching vibrations. The upgraded ilmenite sample contains Ti-O stretching vibrations with more broadness instead of Fe=O and Fe-OH stretching vibrations. Particle size of the four hour milled samples was laid in between 44 to 74 microns. Characterization results show that the amount of TiO_2 and their crystallinity were increased. The annealing temperature can be reduced up to 1000 °C during the studied four hours. Therefore, Sri Lankan ilmenite can be upgraded by ball milling induced carbothermic reduction.

Keywords: Upgrading, Ilmenite, Rutile, Ball milling, Carbothermic reduction