SUPPLEMENTAL INFORMATION:

EXISTING BENEFICIATION PROCESS FOR ILMENITE ORE

Introduction

The Rio Tinto Ore Upgrading Challenge seeks economically-viable new technologies to increase titanium dioxide content in its ilmenite ore from 32% to 50% or better.

From the Challenge Guidelines:

The TiO_2 content within this ore body is concentrated within ilmenite, not within hematite or other silicate gangue (non-valued) minerals. The microstructure of this particular ilmenite ore also shows fine hematite lamellae intergrown in ilmenite. To concentrate the TiO_2, hematite and gangue silicates must be separated as much as possible from the ore. Conventional physical separation and heat treatment techniques have been shown to improve the TiO_2 content only up to 42%. Other pyro/hydrometallurgical upgrading methods (smelting, acid leaching) are projected to be too costly for ilmenite upgrading relative to a sulfate-process feedstock. An economical way to separate hematite particles from ilmenite remains a difficult technical challenge.

Existing Beneficiation Process

Hemo-ilmenite ore is mined and crushed to < 3 inches at the mine. At this step, it contains ~32% TiO_2. No upgrading is done at the mine. This crushed material is the material to work on for this challenge because we would like to implement the new process directly at the mine.

While a variety of treatment techniques for improving TiO_2 content have been tried experimentally (see Challenge Guidelines excerpt above), the current production process does not attempt to remove hematite (only gangue material). The existing process for beneficiation (gangue material removal) is described below and a high-level process graphic is included on the next page.

Today, the crushed material is sent 1000 km away to our smelter site. Further crushing is done at 6.3 mm. The -14 mesh is upgraded by spirals and recombined to the +14 Mesh to be roasted. The roasting oxidizes Fe^{2+} from ilmenite to magnetite. The magnetized ore is separated from the gangue by magnetic separation (upgraded to ~38% TiO_2). The ore is then smelted to separate the iron from TiO_2. Both products are valorized.

For a more detailed description of RTFT process, you can also consult the following paper:

https://www.tandfonline.com/doi/abs/10.1080/08827500600564242

RTFT Beneficiation Flowsheet