Process to recover high purity vanadium pentoxide from vanadiferrous titanomagnetite concentrate

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Keywords: Vanadiferrous titanomagnetite, hydrochloric acid leaching, vanadium recovery, vanadium pentoxide.

ABSTRACT

Vanadium is a critical mineral which has predominantly been used high-strength steel production (85% of usage), however, is increasingly used in redox flow batteries (currently 2% of use). Its demand is forecast to grow significantly due to the increasing requirement for renewable energy storage systems. Vanadium is commonly derived from concentrates (typically vanadium and titanium-rich magnetite) separated from mined ore, or as a by-product of steel-making slags. Existing methods for recovering vanadium from vanadiferrous titanomagnetite (VTM) deposits are either by smelting or salt roast processing, neither of which recovers titanium (another critical mineral).

A novel process has recently been developed at CSIRO that enables the recovery of vanadium, titanium and iron from VTM concentrate in one process. Further refinement of the process is in progress in partnership with an Australian company (Tivan Ltd.) who holds a global licence (excluding India) for commercialisation of the technology.

In this process, VTM concentrate leaching occurs under atmospheric conditions below 100°C using 20-22% w/w hydrochloric acid (HCl). Titanium-rich material suitable as a feedstock to the sulphate processing reports to the leach residue. The resulting leach liquor is reduced before pH adjustment facilitates the precipitation of a vanadium and aluminium (V/Al) intermediate that is further processed to yield a >99.8% V_2O_5 product. After V/Al precipitation, iron remaining in the liquor is recovered as a high iron-grade (>65%), magnetite-rich (>90%) product. After removal of magnesium and manganese, the barren leach solution can be used to regenerate HCl via the addition of sulphuric acid to form high quality anhydrite. The resulting HCl is recycled back to the leaching stage.