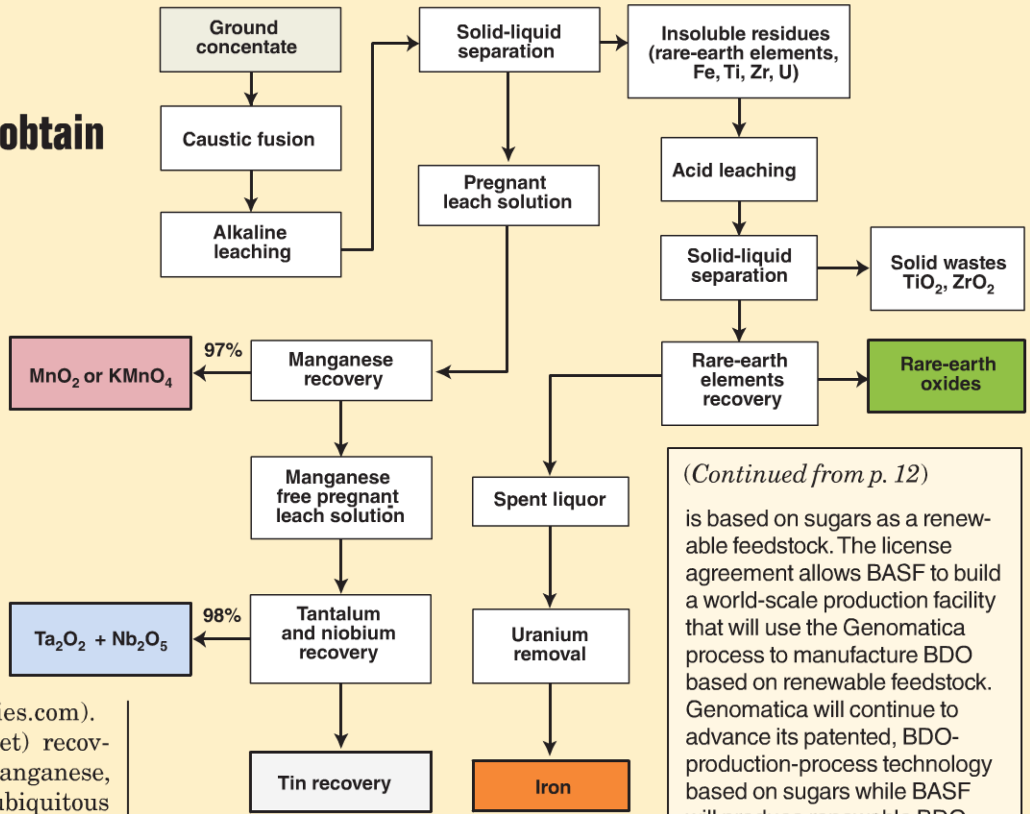
A safer, cleaner way to obtain tantalum and niobium



Tantalum and niobium, which are often found in complex ores, are essentially chemically inert metals whose recovery involves some harsh measures: typically dissolution of the metals concentrate in a mixture of concentrated hydrofluoric and sulfuric acids, followed by solvent extraction with methyl-*iso*-butyl-ketone dissolved in kerosene. A process that is said to be safer and "greener" has been developed and patented by Electrochem Technologies & Materials Inc. (Montreal, Canada; www.electrochem-technologies.com).

Electrochem's process (flowsheet) recovers tantalum and niobium, plus manganese, rare-earth metals, tin and iron — ubiquitous elements found in Ta and Nb ores. Ground concentrate is digested in a molten potassium hydroxide, between 400 and 800°C. The melt resides for less than 1 h in a batch furnace or a rotary kiln to dissolve essentially all the tantalum and niobium, along with manganese and tin. The melt is then solidified and leached by an aqueous solution of KOH to extract Ta, Nb, Mn and Sn from the now-solidified melt. Undissolved solids, including Fe, Ti, Zr, thorium, uranium and rare-earth metals, are filtered out and the metals may be recovered by acid leaching and precipitation.

Mn is obtained from the leach solution either as manganese dioxide or potassium permanganate via a continuous electrochemical process. Next, a saturated aqueous solution of sodium sulfate or chloride is added, then the pH is adjusted to 6–7 (by adding H_2SO_4 or HCl) for selective precipitation of sodium niobate and tantalate. The metals are subsequently acid-leached to produce tantalum and niobium oxides. Finally, tin may be precipitated as tin oxide.

Francois Cardarelli, president of Electrochem, says the process has been tested at a prototype scale and has recovered 98–99% of an ore's content of Ta and Nb. Preliminary cost and benefits analyses indicate that tantalum oxide could be produced for one-third the operating cost of conventional processing, he says. Cardarelli says the initial focus is on tantalum because the daily tonnage is much smaller (hence scaleup is easier) and its value is two or three times that of niobium.

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magnetically susceptible, and thus readily separated from gangue minerals. Although the roasting process renders the titania fraction insoluble in sulfuric acid, the magnetic ilmenite produced in this manner is not a suitable feedstock for the sulfate process. However, this property can be useful if HCl leaching is employed to selectively remove the iron and other soluble constituents to make synthetic rutile. But the process is only economical if the HCl is regenerated.

With EARS, the regeneration of HCl is performed by pyrohydrolysis in a fluidized-bed reactor. The solid-oxide discharge is in the form of small pellets as opposed to the fine powder of spray systems — an advantage in subsequent handling.

Austpac says its process can make synthetic rutile of 97 wt.% TiO_2 from most ilmenites. The Fe component of roasted ilmenite is highly reactive and very readily leached in hot HCl. Any oxides of Ca, Mg, Mn or Al that occur as impurities within the ilmenite are similarly dissolved. Most of the TiO_2 precipitates back into the grains of synthetic rutile by hydrolysis as hydrated oxychlorides, and is later converted to TiO_2 by calcination.

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is based on sugars as a renewable feedstock. The license agreement allows BASF to build a world-scale production facility that will use the Genomatica process to manufacture BDO based on renewable feedstock. Genomatica will continue to advance its patented, BDO-production-process technology based on sugars while BASF will produce renewable BDO, which will be available in the second half of 2013 for sampling and trials.

Lignin recovery

Domtar (Montreal, Québec, Canada; www.domtar.com) has successfully started up a commercial-scale LignoBoost lignin separation plant at its Plymouth, North Carolina mill. This is the first commercial installation of a LignoBoost plant in the world. Domtar's production of BioChoice lignin began in February with a targeted rate of 75 ton/d. Integrated with the pulp mill, the LignoBoost plant separates and collects lignin from the pulping liquor. Lignin is a high-quality bio-based alternative to fossil-fuel based materials, such as fuels, resins and thermoplastics. Separation of a portion of the mill's total lignin production also off-loads the recovery boiler, and allows an increase in pulp production capacity.

The process technology was supplied by Metso Corp. (Helsinki, Finland; www.metso.com). It was originally developed by Innventia (Stockholm), in association with Chalmers University of Technology (both Sweden), and subsequently acquired and further developed by Metso. ❑