Vanadium reserves in India

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In news

Geological Survey of India (GSI) has placed Arunachal Pradesh on the vanadium map of the country

What is vanadium?

- Vanadium in its pure form is a soft, grey and ductile element primarily derived from mined iron ore, carbonaceous shale or phyllites and steel slag
- Vanadium is a chemical element with the symbol V and atomic number 23. It is a hard, silvery-grey, malleable transition metal.
- The elemental metal is rarely found in nature, but once isolated artificially, the formation of an oxide layer (passivation) somewhat stabilizes the free metal against further oxidation
- Vanadium occurs naturally in about 65 minerals and in fossil fuel deposits.
- It is produced in China and Russia from steel smelter slag. Other countries produce it either from magnetite directly, flue dust of heavy oil, or as a byproduct of uranium mining.

Key updates

- The state of Arunachal Pradesh, which is considered a sleeping hydropower giant, could be India’s prime producer of vanadium, a high-value metal used in strengthening steel and titanium.
- Exploration by GSI: Exploration being carried out by Geological Survey of India (GSI) has placed the eastern Himalayan State on the vanadium map of the country and geologists are confident of identifying a deposit soon

In which areas of Arunachal Pradesh GSI found vanadium?

- GSI specialists say that they have found promising concentrations of vanadium in the palaeo-proterozoic carbonaceous phyllite rocks in the Depo and Tamang areas of Arunachal Pradesh's Papum Pare district.
- This was the first report of a primary deposit of vanadium in India with an average grade of 0.76% V2O5 (vanadium pentoxide)
- Geologists discovered two bands of about 7-metre thick carbonaceous phyllite for a length of more than 6 km in the Depo area.
- Good prospects of vanadium for a cumulative length of 15.5 km and an average thickness of 7m were found in the Deed, Saiya and Phop areas of Lower Subansiri district.
- Vanadium content was also found in the Pakro area of Pakke-Kesang district, Palin-Sangram in Kra Daadi, Kalamati in West Siang, Kalaktang in West Kameng and Kaying in Siang district.

Significance of recent findings

- Vanadium mineralization in Arunachal Pradesh is geologically similar to the "stone coal" vanadium deposits of China hosted in carbonaceous shale. This high vanadium content is associated with graphite with fixed carbon content of up to 16%.
- According to GSI, the expected grade of vanadium mineralisation in Arunachal Pradesh is comparable to the important vanadium deposits of the world.
- **The largest deposits are in China, followed by Russia and South Africa**

Status of Vanadium in India

- **India is a significant consumer of vanadium** but is not a primary producer of the strategic metal.
- It is recovered as a by-product from the slag collected

from the processing of vanadiferous magnetite ores (iron ore)

- As per GSI data, India consumed 4% of about 84,000 metric tonnes of vanadium produced across the globe in 2017. China, which produces 57% of the world's vanadium, consumed 44% of the metal.
- According to the Indian Bureau of Mines (2018 database), the total estimated reserves or resources of vanadium ore is 24.63 million tonnes, with an estimated V2O5 content of 64,594 tonnes.

Usage of Vanadium

- It is mainly used to produce specialty steel alloys such as high-speed tool steels, and some aluminium alloys.
- The most important industrial vanadium compound, vanadium pentoxide, is used as a catalyst for the production of sulfuric acid.
- The vanadium redox battery for energy storage may be an important application in the future.

Other benefits of Vanadium

- **Vanadium alloys are durable in extreme temperature and environments**, and are corrosion-resistant. Its addition improves the tensile strength of steel and of reinforcing bars used for buildings, tunnels and bridges.
- **Apart from increasing fuel-efficiency in automotive and aviation industries due to its high strength-to-weight ratio, the metal forms the integral part of vanadium redox batteries that have the least ecological impact in energy storage.**