RBC Thought Leadership

Briefing: Germanium

Overview

Germanium is crucially important in defense and space exploration, thanks to its superior optical and semiconductor properties. Its importance is also growing in telecommunication and computer chip applications in the wake of the artificial intelligence boom. Chinese dominance in Germanium production and processing, coupled with limited substitution options for defense- and space-critical applications, necessitate ensuring domestic supply security.

Canada can enhance the U.S.'s germanium supply security by ramping existing production facilities and growing a Canadian supply chain.

1. Germanium can be partially substituted in some defense applications but is the optimal choice for many.

- A third, or approximately 10 tonnes, of annual U.S. germanium consumption is in defense-relevant applications like lenses and windows for infrared surveillance devices and night-vision equipment.[1]
- Germanium can be substituted (e.g., with zinc selenide, silicon, or sapphire) in certain applications (e.g. medical imaging) but is optimal for long-range infrared applications such as surveillance and remote monitoring of critical infrastructure.[2]

2. The growing use of fibre optic cables in telecommunications could spur further demand.

- Germanium is added to silicon in fibre optic cables to increase signal transmission over long distances.
- Growing demand for fibre optic cables has spurred demand for germanium in recent years.
- Growing AI infrastructure requirements could be a further tailwind for germanium demand as fibre optic cable demand grows to service AI datacenters.

3. Canada can boost U.S. germanium supply security.

- Canada supplied 20% of overall U.S. germanium imports in 2023.[3]
- Europe (Belgium, Germany, and France) have replaced Chinese germanium supply following Chinese export controls in 2023 and an export ban in 2024.[4]
- Canada's Teck Trail zinc smelting project supplied 8 tonnes (or 20%) of the U.S.'s germanium (as chloride and oxide) in 2024, but has historically supplied up to 24 tonnes (or 35%) of germanium imports.[5]

Key Challenges

- Canada relies on imports of zinc concentrate from Alaska to produce germanium compounds and does not produce germanium metal domestically.
- Exploration for germanium-rich deposits in Canada is confined to junior mining companies.[7]
- Germanium's relatively small global market (~$457 million)[8] limits the participation of established mining companies with the development expertise required to grow domestic production.
- European germanium supply is also reliant on Chinese exports.[9]

The Opportunity

- The U.S. lacks primary germanium production capacity.
- Increasing Canadian germanium supply to the U.S. diversifies imports away from China and Chinese-origin sources and can help defer potential strategic reserve drawdowns in the U.S.

References:
1. U.S. Geological Survey and RBC Thought Leadership estimates
2. ibid
3. USGS Mineral Commodity Summaries
4. US Census Bureau
5. USGS: Quantifying Potential Effects of China's Gallium and Germanium Export Restrictions on the U.S. Economy
6. Interview with Natural Resources Canada
7. Assuming 2022 production of 210 tonnes and USD 2,175/kg germanium price.
8. China Customs Statistics