RBC Thought Leadership

Briefing: Gallium

Overview

Gallium is a critical mineral used in the production of highly specialized integrated circuits and semiconductors for uses in Defense and high-performance computing (AI). On defense, gallium-based semiconductors are vital to U.S. next-generation missile defense, radar systems and electronic communications.

The U.S. is 100% import dependent for its supply of gallium. Further, China accounts for over 98% of global primary gallium production and 89% of global productive capacity[1]. The U.S. Geological Survey ranked gallium as the critical mineral with the highest degree of supply risk relative to all critical minerals, as it pertains to national security.

1. Defense is not substitutable

- Best-in-class ability to transmit data at high frequencies and amplify weak signals
- Used across all defense applications; Navy radar on vessels, Army air and air missile defense, and Marine ground-based radar for detecting artillery, missiles and drones
- Alternative minerals (silicon) result in significant loss in performance, almost certainly beyond the Pentagon's threshold of acceptance – especially relative to China's gallium-supplied defense capabilities

2. Increasingly important in advanced computing / AI

- National security concerns around growing use of AI and advanced computing
- Gallium outperforms traditional silicon due to its outperformance on both speed of compute and energy efficiency. Greater efficiency reduces the strain on power and grid use
- Shifting downstream use towards defense and AI are driving demand, but also concerns around supply

3. Canada solving U.S. gallium problems

- Canada supplied 53% of U.S. gallium metal imports in 2024, up from 9% in 2021[2]
- Canadian volumes have effectively displaced Chinese imports, and expected to remain the case given China's recent U.S. gallium export ban (December, 2024)
- Rio Tinto's gallium demonstration project (Saguenay) could add between 5-10% of total global primary gallium metal production if commercially successful

Key Challenges

- Limited 'commercial' use of gallium. The total value of gallium primary metal market is possibly only ~US$300 million[3], likely only drawing interest from junior miners
- Yet downstream use is substantial; a 30% supply reduction could cause a $600 billion drop in U.S. GDP.[1]
- Project/operational risk likely requires the experience and discipline of an established large operator
- Canada's lacks complete security on its own gallium supply chain, depending on imported South American bauxite and/or scrap electronics from Taiwan
- Only addresses metal imports, no imports of highly valued wafers (chips)

The Opportunity

- The U.S. continues to have no domestic gallium production, refining or recycling capacity
- Rising geopolitical tensions is resulting in a re-think of defense needs. Gallium is a NATO critical mineral
- Canadian and Australian miners are considered the most socially responsible (ESG friendly), a key consideration for E.U. countries (the Corporate Sustainability Reporting Directive, CSRD)
- The adoption of AI and resulting AI arms race for semiconductors and power could likely surprise to the upside, providing greater impetus of security of access

References:
1) U.S. Geological Survey
2) U.S. International Trade Commission, data accessed via DataWeb
3) Current global production of 600,000 kg at an assumed US$500/kg gallium price