

INVESTMENT CHALLENGES FOR U.S. PROJECTS

Gallium, vital in electronics, is sourced as a byproduct from bauxite and sphalerite. It undergoes purification, including solvent extraction and electrolysis, to achieve high purity. Essential in semiconductors like gallium arsenide (GaAs) and gallium nitride (GaN), it's used in integrated circuits, LEDs, and solar cells, valued for high-speed operation and thermal stability. With growing demands from 5G and renewable energy sectors, sustainable gallium supply through efficient recycling and innovative extraction is crucial, balancing technological advancement with environmental sustainability.

Applications requiring gallium.

China's Influence	Mining (%)	N/A% ¹
	Processing (%)	98.1%
	Export Rules	Restricted
Electric Vehicles (incl. batteries)		
Aerospace		✓
Defense Technologies		✓
Mobile Electronics (incl. batteries)		✓
Satellites/Space (incl. batteries)		✓
Robotics (incl. batteries)		✓
Wind Turbines		
Solar Panels		✓
Nuclear Power		
Energy Storage		
Grid Infrastructure		
LED Lighting		✓

Risks to establishing domestic gallium processing.

Feedstock Scarcity	Major	Feedstock challenges stem from lack of domestic mining, reliance on by-product extraction from overseas aluminum and zinc production, and intense competition from global demand.
Competition for Labor	Major	Labor hurdles are due to specialized skill shortages, appealing alternatives in other fields, and geographical challenges.
Need for Technical Expertise	Major	Gallium's unique properties requires complex low-temp extraction, improved purification from aluminum / zinc ores, innovative e-waste recycling, integrated with metal processing infrastructures.
Immature Market	Major	There are limited domestic partners in a niche market and high costs due to immature economies of scale, made worse by fierce competition from China, which dominates over 95% of the market.
Lack of Price Competitiveness	Major	Price competitiveness is challenged by China's dominance, which benefits from cheaper labor, energy, and raw materials.
Lack of Investor Interest	Major	Investor hesitation arises from high initial costs, strong competition from South America, electric vehicle demand volatility, and market opacity.

Overview of gallium processing.

Upstream Material	Common Mid-Stream Technologies	Mid-Stream Product Outputs
Gallium-containing materials	<ul style="list-style-type: none"> ▪From Bauxite Residues: <ul style="list-style-type: none"> ○Hydrometallurgy [leaching, SX, electrowinning, precipitation, zone purification (a specialized refining process)] ▪From Zinc Ores <ul style="list-style-type: none"> ○Pyrometallurgy and Hydrometallurgy [roasting, leaching, SX, electrowinning, zone purification] 	High purity gallium metal, liquid metal alloys, and Ga-compounds

¹ Nearly all gallium is a byproduct of processed bauxite and zinc-processing residues.