

## ASX RELEASE

29 November 2024

**MTM & INDIUM INC. ENTER STRATEGIC COLLABORATION FOR  
RECOVERY OF GALLIUM, GERMANIUM & OTHER CRITICAL METALS****WATCH A VIDEO SUMMARY OF THIS ANNOUNCEMENT & ENGAGE WITH MTM [HERE](#).**

- **MTM** forms a strategic partnership with New York-headquartered **Indium Corporation**, one of the Western world's largest suppliers of refined gallium (Ga), germanium (Ge), indium (In), and other specialty technology metals.
- **Collaboration addresses U.S. strategic vulnerabilities** by reducing reliance on foreign metal sources, aligning with upcoming U.S. policy changes that support onshoring and incentivises domestic manufacturing.
- **Access to ultra-high value scrap** containing up to **20% (200,000 ppm) In, 15% (150,000 ppm) Ga, and 18% (180,000 ppm) Ge** – all critical technology metals that have seen prices increase substantially due to strong demand and supply constraints.
- **Innovative and Sustainable Technology:** strategic value of MTM's Flash Joule Heating technology in securing a reliable domestic supply of critical metals essential for modern technology and national security.
- **Letter-of-Support from Indium for a US Department of Energy (DOE):** grant pertaining to 'Advancing Technology Development for Securing a Domestic Supply of Critical Minerals and Materials'.
- **The partnership addresses critical supply chain vulnerabilities identified by the U.S. Geological Survey (USGS),** including the risk of severe economic disruption from Chinese export restrictions on Gallium and Germanium.

**MTM Critical Metals Limited** ("MTM" or the "Company") (ASX: MTM) is pleased to announce a strategic collaboration with [Indium Corporation](#) ("Indium"), one of the Western world's leading suppliers of refined gallium, germanium, indium, and other specialty technology metals.

This collaboration aims to create a U.S.-based processing solution using MTM's innovative Flash Joule Heating (FJH) technology to recover high-value metals - including gallium, germanium, indium, and tin - from various scrap sources. By establishing an onshore processing capability, the partnership addresses strategic vulnerabilities in the U.S. supply chain, reducing reliance on imports from China which currently dominates global supply and processing of these metals and has previously curtailed supply by restricting exports of refined metals.

Under a Memorandum of Understanding (MOU), MTM will process scrap materials rich in Ga, Ge, In, and Sn provided by Indium Corporation, with a focus on developing advanced recovery methods using the Flash Joule Heating (FJH) technology. This initiative aligns with U.S. efforts to establish a secure domestic supply of critical materials. Testing on Indium-supplied feedstocks is already underway at MTM's Texas-based laboratory.

**Indium's Global Business Unit Manager Markus Roas commented:** *"This partnership with MTM aligns with our commitment to enhancing U.S.-based supply chains for critical metals essential to modern technologies. FJH technology offers a novel and sustainable solution to recover these vital elements from waste materials, ensuring reliable access without relying on external sources. We are excited to support this collaboration in addressing the strategic needs of our country. At Indium, we believe that secondary raw materials and urban mining will become key pillars for the future, and we are excited to support this collaboration in addressing the strategic needs of our industry."*

**MTM's Chief Executive Officer, Michael Walshe, said:** *"We are thrilled to partner with Indium, a global leader in critical technology metals, to secure a U.S.-based supply of metals essential to the defence, semiconductor, and high-tech industries. This collaboration represents a significant milestone for our company, **providing strong external validation of our technology**. Together, we are tackling supply chain vulnerabilities with an innovative approach to efficiently recover critical metals domestically, advancing U.S. efforts towards critical metal independence."*

### Validation of Flash Joule Heating Technology

The collaboration with Indium not only highlights the potential of MTM's FJH technology but also provides a strong endorsement from a leader in the technology metals sector. FJH technology, developed in collaboration with Rice University in Houston, Texas, represents an important advancement in metal recovery, reducing environmental impact, energy consumption, and processing time compared to traditional methods.

MTM is actively applying for government grants based on supply of critical materials and has received a **Letter-of-Support from Indium** for a US Department of Energy (DOE) grant pertaining to 'Advancing Technology Development for Securing a Domestic Supply of Critical Minerals and Materials'. The quantum of funding of this grant is US\$3-10M and the final figures for the successful applicants will be decided by April 2025. Indium have agreed to provide feedstock to support this grant application.

### Positioned for new U.S. Policy Changes

The partnership may benefit from the recently announced policy initiatives under the incoming Trump administration, which emphasises onshoring critical metal supply chains, imposing tariffs on Chinese imports, and providing incentives for domestic manufacturing. **MTM and Indium's collaboration aligns closely with these policies, which are expected to encourage U.S. companies to develop local solutions, ensuring a steady, reliable supply of crucial materials.** These initiatives position the partnership to make a meaningful impact on the resilience and security of the U.S. supply chain for high-demand technology metals.

### The Gallium, Germanium & Indium Markets

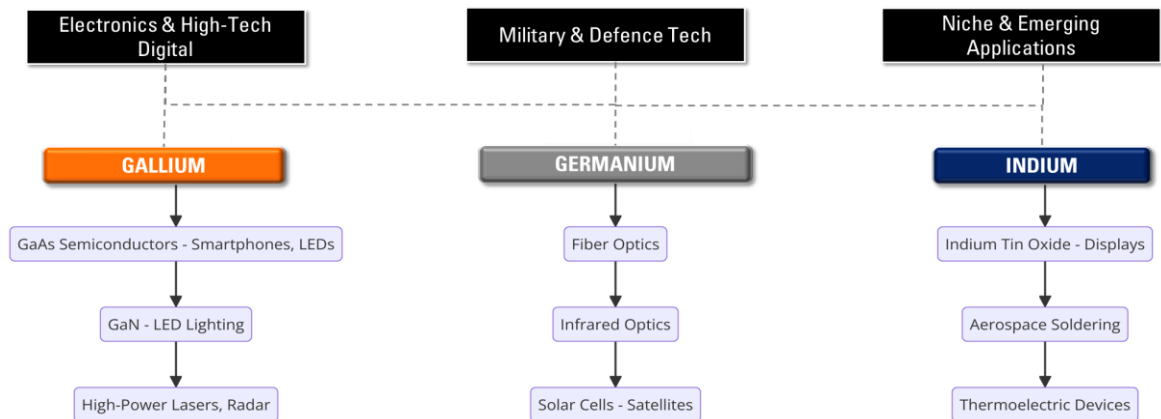
Gallium, Germanium, and Indium are critical metals with markets largely driven by demand in electronics, high-tech applications, and advanced military technologies.

- **Gallium:** Approximately 75% of gallium demand stems from gallium arsenide (GaAs) semiconductors, essential in smartphones, LEDs, and other devices. Gallium nitride (GaN), vital for LED lighting, has also propelled market growth. In military applications, GaAs and GaN semiconductors are crucial for high-frequency, high-power systems like radar, electronic warfare, and satellite communications. Gallium compounds are used in thermal imaging devices and high-power lasers for targeting and range-finding.
- **Germanium:** Valued for its semiconductor properties, germanium is primarily used in fibre optics, infrared optics, and solar cells. In defence technology, germanium's optical properties make it ideal for infrared lenses and sensors in night vision systems, thermal imaging cameras, and guided missiles. It's also used in fibre optics for secure military communications and in solar cells for satellites.
- **Indium:** The principal use is in indium tin oxide (ITO), a transparent conductor for touchscreens, LCDs, and various display technologies. In military tech, indium is used in displays and control panels for vehicles and aircraft. Indium-based solders are favoured in aerospace and military electronics for their reliability under extreme temperatures.

**Emerging and Niche Applications:** Beyond mainstream electronics, these metals support specialized technologies. Gallium is crucial for copper-indium-gallium-selenide (CIGS) photovoltaic cells, an emerging solar

market segment. Germanium is used as a polymerization catalyst and in CIGS solar cells. Indium finds niche applications in low-melting-point alloys, semiconductors, and thermoelectric materials.

**Supply and Recycling Trends:** Supply is predominantly tied to byproducts of major metal refining processes, with China as the leading supplier: Gallium—Extracted from bauxite during aluminium refining; Germanium—Recovered from zinc ore processing and coal combustion byproducts; Indium—Obtained as a byproduct of zinc refining.



**Figure 1: Ga, Ge & In markets largely driven by demand in electronics, high-tech, and advanced military technologies**

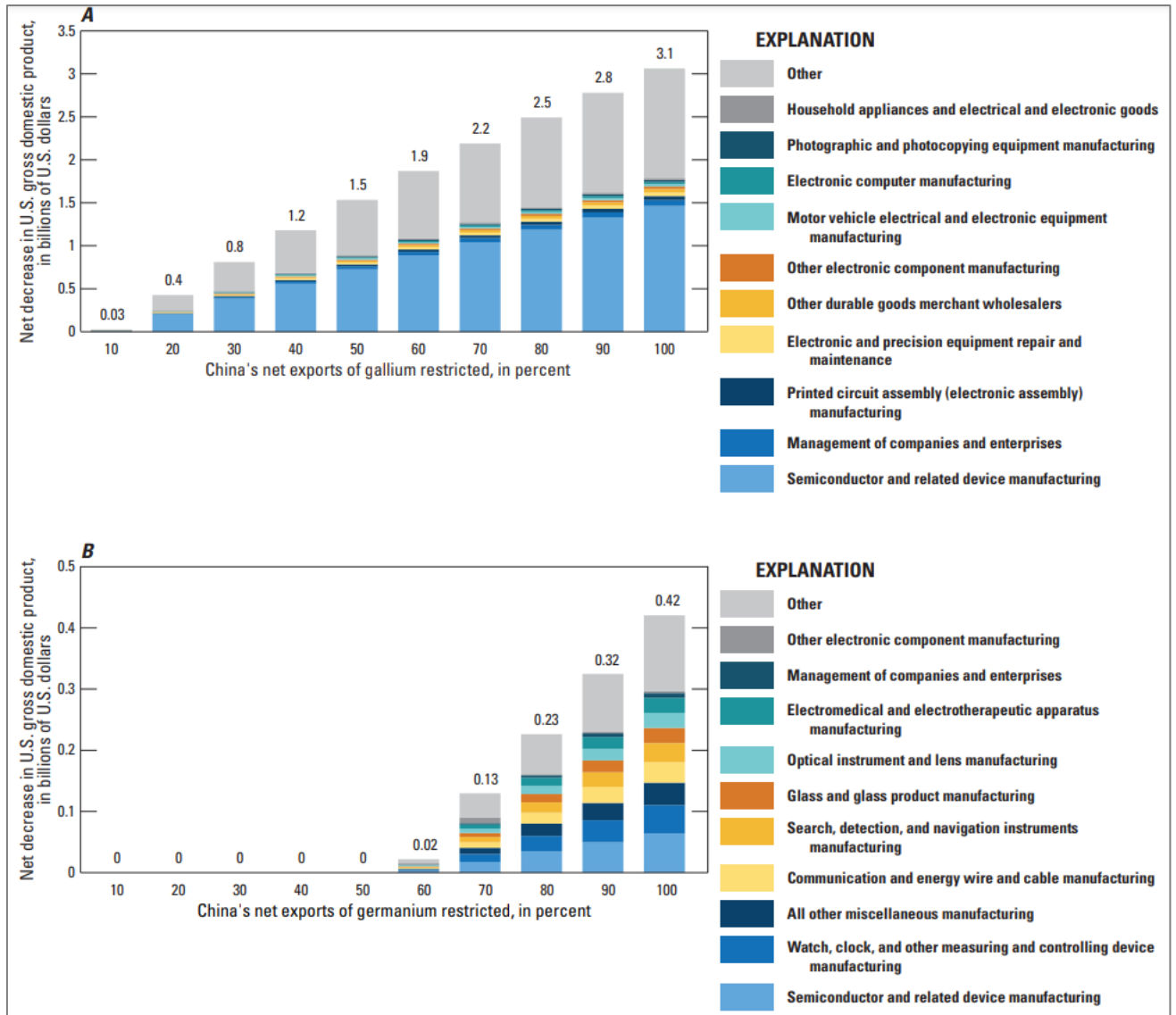
The strategic importance of gallium, germanium, and indium in critical and highly sensitive commercial and military technologies underscores the need for secure and diversified supply chains, especially in light of potential geopolitical risks and export restrictions.

## Supply Chain Risks and Economic Impact

The collaboration between MTM and Indium Inc. is particularly timely, given the findings of a recent U.S. Geological Survey (USGS) report<sup>1</sup> which highlights the severe economic implications of gallium and germanium supply chain disruptions. According to the study:

- a complete export ban by China on these critical minerals could result in a **significant reduction in U.S. GDP** (see Fig. 2).
- The semiconductor manufacturing sector, which relies heavily on gallium and germanium, would bear substantial and catastrophic economic losses, with additional downstream impacts across various industries, including electronics and defence.
- The report underscores China's dominant position, producing over 95% of the global gallium supply, and its increasing use of export controls as a geopolitical tool, as evidenced by the export licensing restrictions imposed in 2023.
- Moreover, China's dominant role in the production and export of gallium and germanium poses significant risks to global markets.
- A complete export ban could reduce global gallium availability by ~40% and increase prices by over 250%. These disruptions would severely impact downstream industries reliant on these materials.
- Gallium and germanium are primarily byproducts of aluminium and zinc production, making their supply highly price inelastic. This dependency amplifies the risks associated with supply disruptions.

<sup>1</sup> Nassar, N.T., Applegate, D. & Amgott, S., 2024. *USGS Critical Minerals Study: Bans on Gallium and Germanium Exports Could Cost the U.S. Billions*, U.S. Geological Survey, Reston, VA. <https://pubs.usgs.gov/publication/ofr20241057>



**Figure 2: Estimated net decrease in U.S. gross domestic product at different levels of restrictions of China's net exports of A, gallium or B, germanium, by industry (Nassar et.al 2024 / USGS, 2024)**

MTM and Indium's partnership directly addresses these risks by leveraging MTM's proprietary FJH technology to establish a sustainable and reliable domestic supply chain for gallium, germanium, and other specialty metals. This initiative aligns with USGS recommendations to mitigate supply chain vulnerabilities, including investing in technologies to recover critical minerals from mine waste and e-waste, and enhancing U.S. stockpiles of these metals. By creating a localised processing capability, the collaboration not only bolsters U.S. supply chain resilience but also supports the semiconductor industry's long-term stability, reducing reliance on Chinese imports and insulating the economy from future supply disruptions (Nassar et al., 2024).

Under the incoming Trump administration, the emphasis on strengthening U.S. industrial and economic independence is expected to drive significant policy shifts. These may include tariffs on imports of critical minerals like gallium and germanium from China, enhanced incentives for domestic manufacturing, and expanded federal funding for critical mineral recovery and recycling technologies. MTM and Indium's partnership aligns closely with these anticipated policies by establishing a U.S.-based processing capability for critical metals. This positions the collaboration to leverage federal support while reducing reliance on foreign imports, bolstering both national security and economic resilience in strategically vital sectors such as semiconductors and defence.

## Impact of Chinese Export Controls on Global Germanium and Gallium Supply Chains

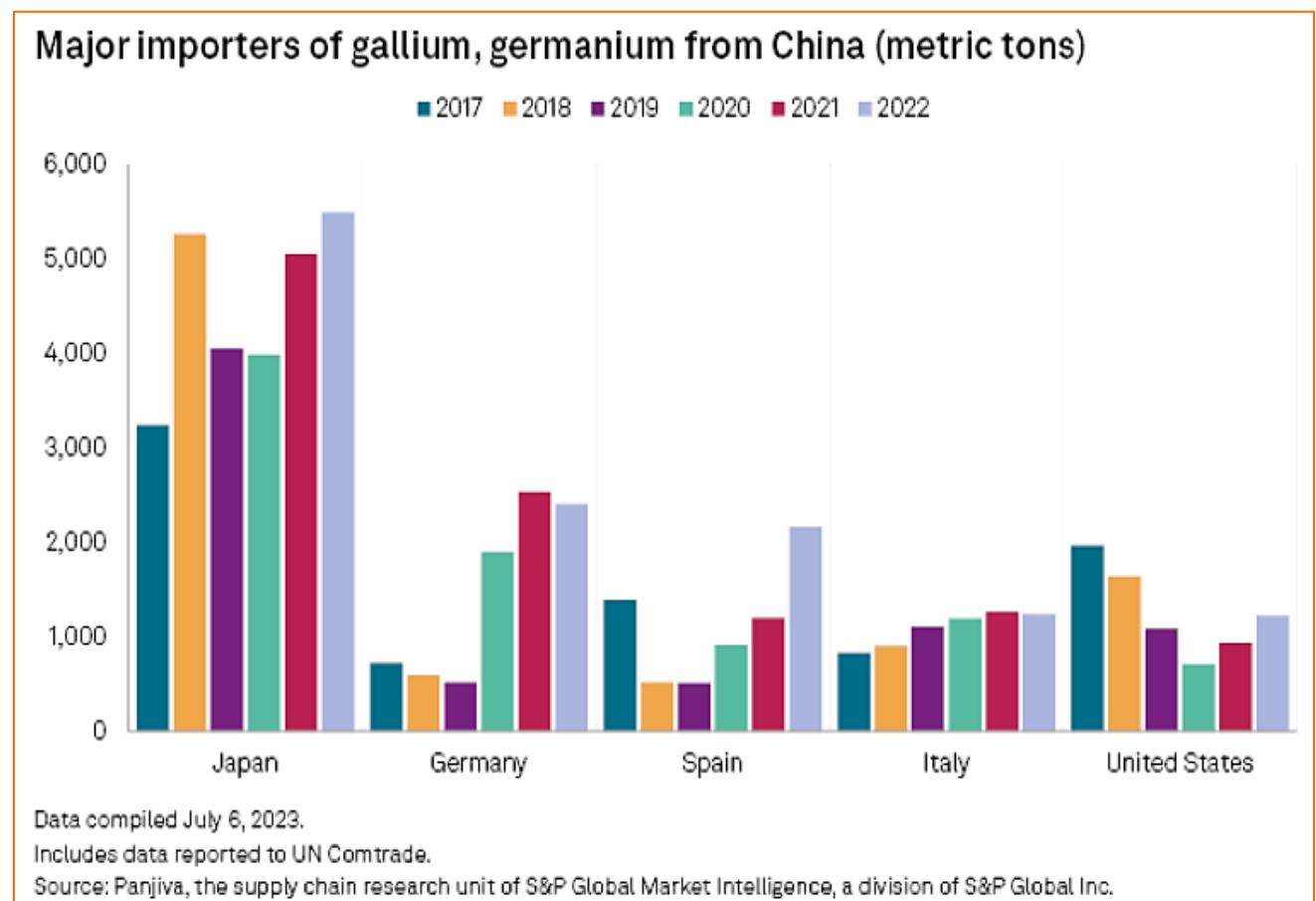
**Chinese Export Controls:** On August 1, 2023, China imposed export controls on critical minerals, including **germanium and gallium**, significantly impacting the global supply chain (S&P Global 2024).

**USA Reliance on Imports:** US is 100% reliant on imports of germanium and gallium, particularly from China, which is the dominant global producer. Current domestic US Ga stockpiles are non-existent (USGS 2024).

**Chinese Production Dominance & Global Supply Concerns:** China produces >95% of the world's gallium with no domestic production noted in the USA (Bloomberg 2024).

**Lack of Gallium Stockpile:** Unlike germanium, there is currently no known strategic stockpile of gallium in the United States (USGS 2024).

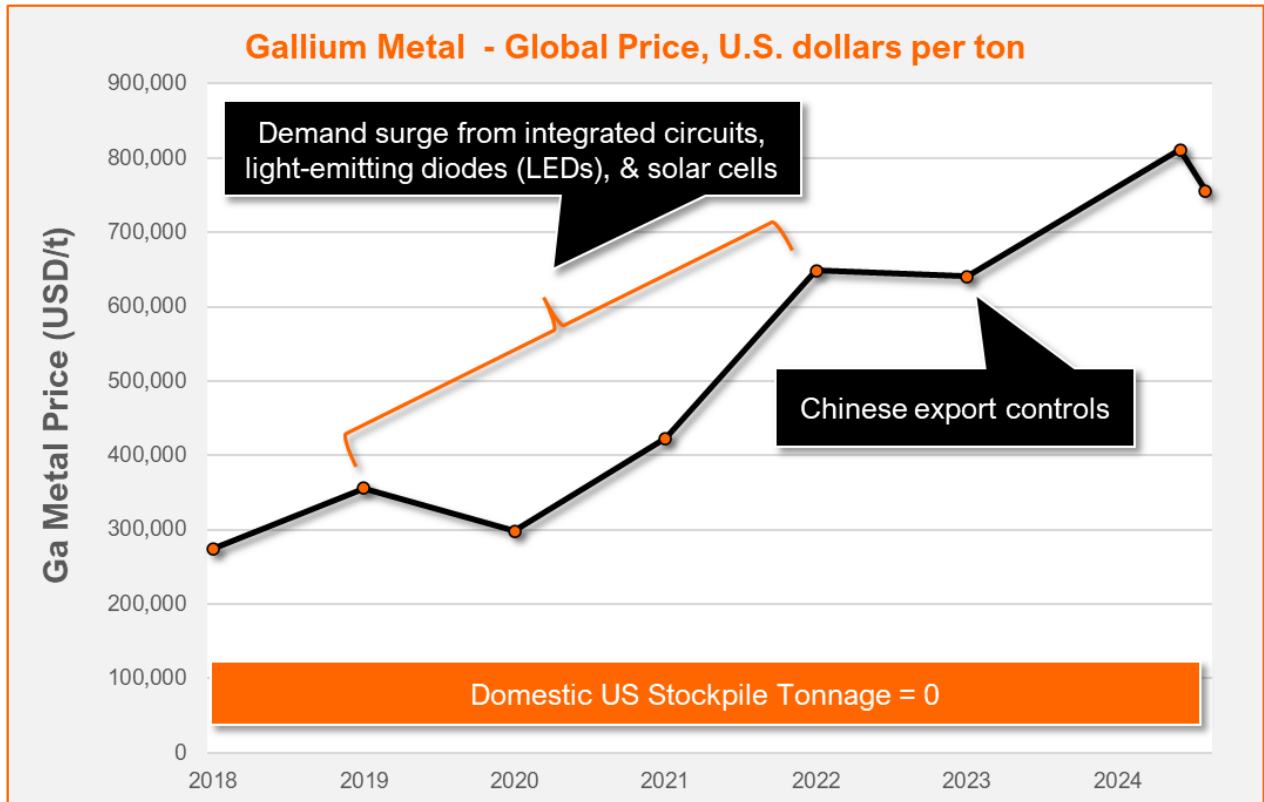
**Supply Chain Disruptions & Risk for Western Nations:** **Several western nations are 100% reliant on gallium imports from China.**



**Figure 3:** Major Gallium & Germanium Importers. Source: S&P Global (2023)

**Recent Chinese Export Data:** Following the implementation of supply controls in Aug 2023, China's exports of germanium and gallium plummeted, with none recorded between Aug. & Sept. 2023, and only minimal quantities in Oct. 2023. Although exports have resumed since then, volumes remain significantly lower (Bloomberg 2024).

**Price Surge:** Following China's export controls in Aug. 2023, gallium prices surged by 27% within a week, with continued increases seen in the following months. By December 2023, global prices had increased by 68% since July 2023 with the upward trend ongoing (S&P Global 2024).



**Figure 4:** Global Gallium Metal Price Trend since 2018. Source: Statista (2024), USGS (2024)

**DATA SOURCES:** Source: Statista (2024), USGS (2024), S&P Capital IQ (2024); Bloomberg (2024)

## Memorandum of Understanding Details

Under a non-binding Memorandum of Understanding (MOU), MTM will process scrap materials rich in Ga, Ge, In, and Sn provided by Indium Corporation, with a focus on developing advanced recovery methods using the Flash Joule Heating (FJH) technology. This initiative aligns with U.S. efforts to establish a secure domestic supply of critical materials. Testing on Indium-supplied feedstocks is already underway at MTM's Texas-based engineering partner's laboratory, advancing the development of this sustainable and innovative recovery solution.

### OBJECTIVES OF THE COLLABORATION

- **Feedstock Supply:** Indium will supply MTM with feedstock containing gallium and other metals of interest ("Feedstock").
- **Metal Recovery:** MTM will apply its proprietary processes to recover the target metals from the Feedstock provided by Indium and supply samples of these metal products (or their derivatives) back to Indium.
- **Data and Commercial Information Sharing:** Both parties will share data and commercial information necessary to assess the viability and mutual benefits of the collaboration.
- **Future Agreements:** If proof-of-concept testing of the Feedstock is successful, the parties intend to negotiate a formal supply and offtake agreement, and / or a potential scrap supply agreement, that would set the terms for an ongoing business relationship.

### ROLES AND RESPONSIBILITIES

#### MTM Critical Metals Ltd.

- Conduct testing and proof-of-concept trials on the Feedstock provided by Indium.
- Recover gallium and other target metals (or their derivatives) from the Feedstock and supply samples of these to Indium.

- Analyse pre- and post-processing sample compositions.
- Share results and relevant data with Indium to assess potential for commercial scale-up.

**Indium Inc.**

- Supply Feedstock containing target metals to MTM.
- Provide relevant Feedstock composition data and handling guidelines.
- Engage with MTM in discussions of the relative quality and quantity of the recovered products.

**TERM AND TERMINATION**

This MOU will remain in effect for a period of **twelve months** from the date of signing, unless extended by mutual agreement or terminated by either party with thirty (30) days written notice. Termination of this MOU shall not affect any accrued rights or obligations of either party, including confidentiality and data sharing.

**CONSIDERATION**

Not relevant to the current MOU

HEAR MANAGING DIRECTOR MICHAEL WALSH DISCUSS THIS ANNOUNCEMENT AND ENGAGE WITH THE MTM TEAM [HERE](#).

**This announcement has been authorised for release by the Board of Directors.**

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**For further information, please contact:**

**Michael Walshe**

Managing Director & Chief Executive Officer  
MTM Critical Metals Ltd  
[info@mtmcriticalmetals.com.au](mailto:info@mtmcriticalmetals.com.au)  
Perth, Western Australia

**Steve Ragiel**

President  
Flash Metals USA Inc. (100%-owned MTM subsidiary)  
[info@mtmcriticalmetals.com.au](mailto:info@mtmcriticalmetals.com.au)  
Houston, Texas, USA



## ABOUT MTM CRITICAL METALS LIMITED

**MTM Critical Metals Limited** is an ASX-listed company headquartered in Perth, Western Australia, with a dual focus on metal recovery technology development & mineral exploration. MTM's 100%-owned USA subsidiary **Flash Metals USA Inc** is based in Texas, USA. MTM possess exclusive licensing rights to the innovative *Flash Joule Heating technology*, a cutting-edge metal recovery and mineral processing method developed by esteemed researchers at Rice University, USA. Additionally, MTM holds exploration assets prospective for niobium (Nb), rare earth elements (REE), and gold, strategically located in Western Australia and Québec.

- Flash Joule Heating (FJH) is an advanced electrothermal process that enhances metal recovery and mineral processing compared to traditional methods. By rapidly heating materials in a controlled atmosphere, FJH efficiently extracts metals like lithium from spodumene, gallium from scrap, and gold from e-waste, among others. This technology has the potential to revolutionise metal recovery by reducing energy consumption, reagent use, and waste, offering a more economical and environmentally friendly alternative.
- MTM's West Arunta Nb-REE exploration assets are situated in one of Australia's premier exploration hotspots, where over \$60 million has been invested by ASX-listed companies such as WA1 Resources, Encounter Resources, Rio Tinto (in JV with Tali Resources), and IGO Limited. MTM also holds tenements in other key mineral regions across Western Australia, including the Mukinbudin Nb-REE Project, East Laverton Gold & Base Metals Project, and Mt Monger Gold Project. In Québec, the Pomme Project is a highly promising carbonatite intrusion rich in REE and niobium, located near the world-class Montviel deposit.

To learn more, visit:

**Website:** <https://www.mtmcriticalmetals.com.au/>

**MTM's Investor Hub:** <https://investorhub.mtmcriticalmetals.com.au/>

## ABOUT INDIUM CORPORATION

**Indium Corporation Inc. (Indium)** is a globally recognized supplier of specialty metals, including gallium, germanium, and indium, essential for industries such as defence, semiconductors, and high-tech manufacturing. Indium is one of the Western world's leading providers of these refined metals, supporting critical technology sectors and supply chain resilience in the U.S.

Indium is a premier materials refiner, smelter, manufacturer, and supplier to the global electronics, semiconductor, thin-film, and thermal management markets. Products include solders and fluxes; brazes; thermal interface materials; sputtering targets; indium, gallium, germanium, and tin metals and inorganic compounds; and NanoFoil®.

Founded in 1934 in New York, USA, the company has global technical support and factories located in China, Germany, India, Malaysia, Singapore, South Korea, the United Kingdom, and the U.S.

<https://www.indium.com/>

## REFERENCES

- **Bloomberg 2024**, 'Gallium Has More Than Doubled in Price on China Export Curbs', <https://www.bloomberg.com/news/articles/2024-04-03/critical-metal-hit-by-china-curbs-has-more-than-doubled-in-price?embedded-checkout=true>.
- **Nassar, N.T., Applegate, D. & Amgott, S., 2024**. *USGS Critical Minerals Study: Bans on Gallium and Germanium Exports Could Cost the U.S. Billions*, U.S. Geological Survey, Reston, VA. <https://pubs.usgs.gov/publication/ofr20241057>
- **S&P Capital IQ 2024**, 'Uncertainties abound around China's gallium, germanium export controls', *Commodity Insights – Gallium*.
- **Statista 2024**, Gallium price worldwide from January 2018 to January 2024, <https://www.statista.com/statistics/1443942/gallium-global-price/>
- **United States Geological Survey (USGS) 2024**, Gallium Mineral Commodity Summaries 2024, <https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-gallium.pdf>