Industrial Minerals review 2023

by Mike O'Driscoll*

Is the "Criticality" of industrial minerals finally being understood?

The importance of industrial minerals to the world economy and everyday lives always used to be a hard sell to the uninitiated. Just having to explain what they are and how they are characterized in the context of the world mining industry was often a steep learning curve for some (especially startup newcomers and those from the metallic minerals sector wishing to diversify for a quick buck).

Often misunderstood, their value frequently underestimated, and even disparaged as "the third world" of the mining industry, industrial minerals have not always had an easy ride.

But that was then, and this is now. 2023 might be considered the year that (finally) marked the decade of industrial mineral criticality recognition.

We know that industrial minerals are the building blocks of our economy and essential to our everyday life, but owing to several factors (such as supply-chain vulnerability exposed by the COVID-19 pandemic, shipping crises, the Russia-Ukraine war, overreliance on China, new technologies), the last few years have seen a growing awareness of industrial minerals' importance in the mainstream — that is, not just by the wider industry, but crucially, by state and national governments and the public sector.

Even the Industrial Minerals Association-North America (IMA-NA), after having represented the industrial mineral mining industry since 2002, decided to rebrand in 2023 and change its name to the Essential Minerals Association (EMA). It was decided that IMA-NA simply did not "fit the mission and nature of the industry."

Industrial minerals to the rescue — national defense role

Nothing sharpens a government's mind more than issues surrounding a state's defense capabilities.

In a recent article for IMFORMED, Nicholaus Rohleder, cofounder of Climate Commodities, eloquently made the case that the nexus between industrial minerals and national security is a topic of paramount importance, often overlooked in broader discussions about defense readiness and strategic autonomy.

Refractories, materials that are resistant to heat and wear and composed of specific industrial minerals, are indispensable in industries that require high-temperature processes, such as steelmaking, a vital component in military hardware production.

Key minerals, such as bauxite, alumina, andalusite, magnesite and graphite, are not just commodities; they are strategic assets that empower nations with the capability to produce armor, weaponry and other critical military infrastructures. Similarly, the abrasives market, which includes materials used for cutting, grinding and polishing, depends on minerals like fused alumina, silicon carbide, garnet and diamond. Precision manufacturing and maintenance processes for military equipment require the highest-quality abrasives to ensure performance and reliability under the most extreme conditions.

These minerals' strategic importance is also reflected in the geopolitical dynamics of supply and demand, with nations now increasingly aware of the need to secure reliable sources.

Revolutionary drivers from the energy sector

In this author's career of some 35 years in the industry there have been several notable industry milestones. But in recent times perhaps the two most significant standout gamechangers — and that remain ongoing — which have helped spotlight industrial minerals have been unconventional oil/gas resource development by hydraulic fracturing (fracking), and the new battery "revolution" as part of our fledgling energy transition.

Interestingly, and maybe unsurprising to some, their common denominator is our demand for energy sources (although, often easily forgotten in the hot air of debate, oil is also a raw-material feedstock for the massive petrochemical industry).

Fracking had been around since 1949, was further developed in the 1980s, and then, in the early to mid-2000s came the phenomenal boom in fracking, the "shale gale." This was facilitated by developments in horizontal drilling techniques, using massive volumes of improved mineral-based proppants (mainly silica sand, but also kaolin and bauxite for ceramic proppants) to exploit much-needed cheap shale gas and oil from otherwise earlier unexploitable resources (mainly in North America, but also elsewhere).

Wisconsin was turned into a frac sand mine, since superseded by west Texas. In the United States at least, the humble silica sand has never looked back.

From the early 2000s it was obvious that a

new era for battery development was occurring with the research and development, then commercial manufacturing of lithium-ion (Li-ion) batteries for all kinds of high-tech consumer and industrial devices, plus municipal storage.

This has opened up a huge, and ongoing market for a range of minerals (including lithium, graphite, nickel, cobalt and manganese) and, most recently, massively raised awareness of their vulnerabilities in availability, sourcing and supply chains.

The battery market continues to evolve with new battery chemistries and applications for more minerals used in niche components of the Li-ion battery (such as fluorspar and high-purity aluminas), and demand for more commercially developed sources of those industrial minerals.

All this has led to the advent of "critical raw materials" (CRM) and their mainstream recognition by media and state governments. Although, frankly speaking, CRM have always been around and recognized in other industries over the last three decades: rare earth minerals, for example.

But it's not all about just lithium and graphite, other industrial minerals are emerging onto the CRM stage, such as salt and fluorspar, which are worth looking at as examples.

Salt — a critical mineral in the wings?

Since around the mid-2000s, various organizations and states have used criteria to define their respective CRM lists, commonly entailing compilation of a criticality matrix with supply risk and economic importance as key parameters.

Last year, speaking at IMFORMED's Salt Forum 2023 in Namibia, Jack Bedder, founder and director of Project Blue, highlighted the energy transition as requiring both the "usual" and "unusual suspects" as essential, and postulated that salt may play a part if sodium-ion (Na-ion) batteries take off.

Salt is certainly of economic importance, although not a supply risk, though some countries do rely on imports for their salt requirements (the United States has a 25 percent net import dependency on salt; sources are Canada, Chile, Mexico and Egypt).

Things are heating up for Na-ion batteries, especially in China. In 2022, HiNa Battery commissioned the first GWh-scale Na-ion battery production line in Anhui. There are another 35 plants being built. Meanwhile, Chery,

a Chinese carmaker, is using CATL's Na-ion battery, alongside some Li-ion batteries, in its new "icar" brand, launched in April 2023.

In Project Blue's high case scenario, the salt required to process and produce Na-ion batteries in 2050 would approach 3 Mt (3.3 million st), which is roughly 1 percent of the current total production of processed salt in 2023.

This scale of potential Na-ion demand could elevate sodium, and the salt required to produce it, into critical material status for delivering energy transition.

Fluorspar — finally achieving recognition

Fluorspar had already made the CRM lists of the EU and the United States (only added in 2018), and in December 2023 it was added to Australia's CRM list.

Fluorspar is essential as the primary feedstock for hydrofluoric acid (HF) manufacture (the precursor to a wide range of fluorochemicals), and is vital in steel and aluminum production. However, its "criticality" has been "raised" owing to its projected demand for use in the manufacturing of Li-ion batteries, solar panels and semiconductors.

In Li-ion batteries, fluorspar is the feedstock source for lithium hexafluorophosphate ($LiPF_6$), used as an electrolyte, and for polyvinylidene fluoride (PVDF), used as separators, coatings and binders. PVDF is also used in backing sheets for solar panels.

In semiconductor manufacturing, HF with greater than 99.99 percent purity is required in the etching process for semiconductors and for removing impurities from the final silicon chip.

World sources of fluorspar are limited. The United States has no established domestic source of fluorspar and is 100 percent net import reliant, supplied by Mexico, Vietnam, China and South Africa. While Canada Fluorspar Inc. is yet to restart operations in Newfoundland, a new U.S. fluorspar mine is in development by Ares Strategic Mining Inc. near Delta, UT (mine and plant construction underway), which will provide an interesting, and for U.S. consumers much-needed, alternative source. New sources are also being evaluated in Europe and Australia.

U.S. and Europe response

The United States relies on significant imports of industrial minerals: in 2023, according the U.S. Geological Survey (USGS), 32 industrial minerals had 20 percent or greater net import dependency, of which 24 industrial minerals were at 50 percent or greater import dependency (including nine at 100 percent). Eighteen, or more than 50 percent, of the minerals were sourced from China (six at 100 percent, eight at greater than 50 percent, and four at 20 to 28 percent). Graphite, fluorspar and refractory bauxite are in the 100 percent category, and fused alumina at greater than 95 percent.

A series of actions by the U.S. government between 2018 and 2023 have addressed domestic supply-chain vulnerabilities for CRM, with the Inflation Reduction Act of 2022 foremost among these. Several investments were announced in 2023 to address the domestic availability and supply of CRM, including lithium and graphite projects. Most recently, in May this year, the U.S. government announced increased import tariffs on Chinese goods such as electric vehicles, Li-ion batteries, graphite and other "critical minerals," including "aluminum ores and concentrates."

At the same time, the European Council formally adopted the Critical Raw Materials Act (CRMA) to establish a framework to ensure the secure and sustainable supply of CRM by identifying 34 critical and 17 strategic materials crucial for green and digital transitions, and the defense and space industries.

How these actions will unfold and assist desired rapid Western development of CRM remains to be seen — there are many doubters out there. The USGS Critical Minerals List is due for revision in 2025, it will be interesting to see if any further industrial minerals make the so-called CRM grade. ■

**Mike O'Driscoll is director and cofounder of IMFORMED Industrial Mineral Forums & Research Ltd, UK; organizing Fluorine Forum 2024, Ulaanbaatar, Oct. 14-16; China Refractory Minerals Forum 2024, Dalian, Oct. 21-23; and Salt Forum 2024, Abu Dhabi, Nov. 18-20; Email mike@imformed.com or visit www.imformed.com.*

Editor's notes: (1) The articles provided by the U.S. Geological Survey (USGS) in this section, edited by Jim Norman, are based on data included in the USGS Mineral Commodity Summaries 2024 (https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries). The USGS Mineral Commodity Summaries are published on an annual basis; this report is the earliest government publication to furnish estimates covering nonfuel mineral industry data. Data sheets contain information on the domestic industry structure, government programs, tariffs and five-year salient statistics for more than 90 individual minerals and materials. **Disclaimer:** Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.
(2) Throughout this review, measurements are expressed as metric units unless the author provided conversions.