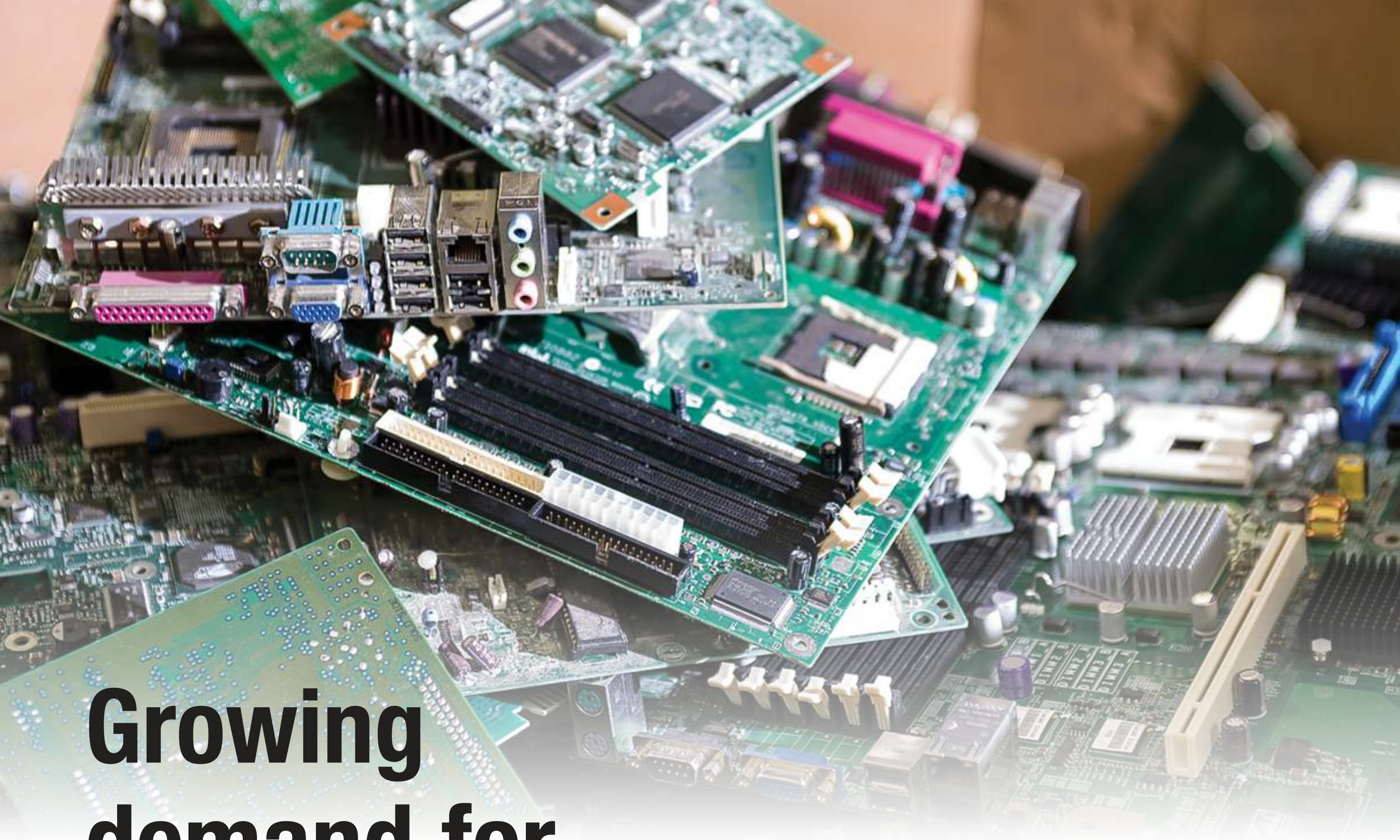


Growing demand for electronics… and ceramic components

By Patty McKenzie

When people outside the industry think of ceramics, they most likely do not think of electronics. But in fact, ceramics are an important component in many of the electronics used today.

The size of the global electronics ceramics market is expected to reach almost $16 billion by 2026,[1] driven by rising demand for phones, tablets, and other e-products that are a part of everyday life. Ceramics are often used as the "package" for microchips or integrated circuits because of their excellent thermal conductivity and resistance to chemical erosion.

While the proliferation of electronics has benefited people worldwide with unprecedented access to information, education, healthcare, and financial services, the current rate of growth and consumption of resources is not sustainable. Faster, smarter, more feature-rich devices are released with ever-growing frequency, replacing their older model counterparts. But what happens to the estimated 54 million tons of electronics that are discarded every year?

Estimates for global recycling rates for electronics range from 15–30%. These rates mean the vast majority of electronics are instead accumulating in closets, offices, basements, and landfills, where the potential for reuse or recycling remains largely untapped. It is estimated that the value of reusable resources from discarded electronics is more than $55 billion each year.[2] In addition to sacrificing the value that could be gained from those products, it depletes the limited supply of resources necessary to produce those products.

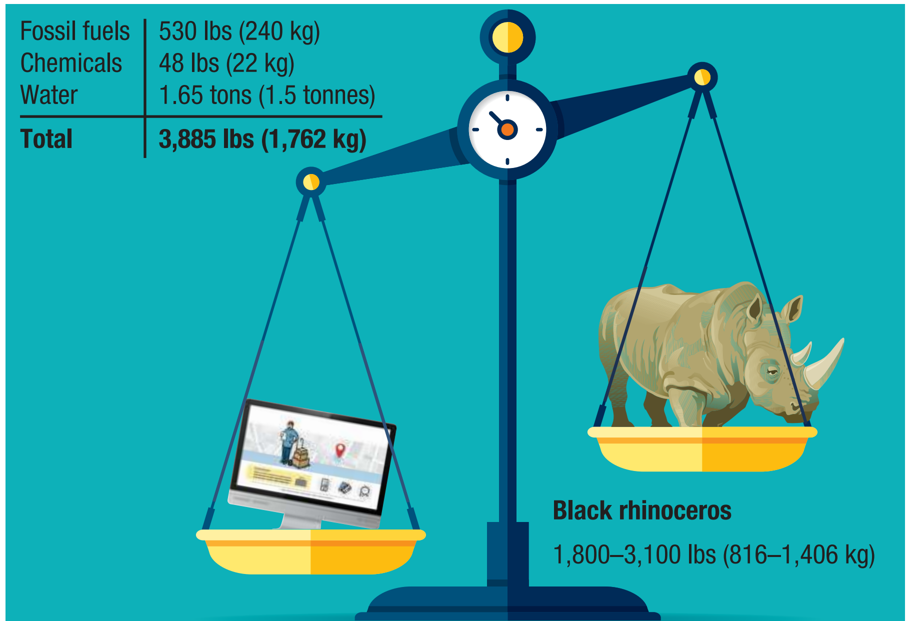
The new movement toward a circular economy is a more sustainable model. A circular economy maximizes the value of products throughout their life cycles. Recycling plays an important role, but extending the useful life of products takes center stage because of the greater environmental benefits of reuse—particularly so when it comes to electronics. The manufacturing process for a laptop accounts for as much as 70% of the total energy the laptop will consume throughout its entire lifecycle.[3] A United Nations University study[4] found that manufacturing a single computer and screen used 530 pounds of fossil fuels, 48 pounds of chemicals, and 1.65 tons of water. With so much invested in the production, lengthening the lifespan of electronic products only makes sense. The good news is that repaired and refurbished electronics can perform as new if loaded with updated software and drivers, and the lifespan can easily be doubled, or even tripled.

When reuse in no longer a viable option, a circular economy maximizes value by harvesting parts and components that can be used in future repairs, or even to manufacture entirely different products. And when harvesting options have been exhausted, materials recovery is the next step. Many different precious metals and other elements can be successfully recovered and reintroduced into the manufacturing stream, reducing the demand for limited supplies of natural resources.

Ceramics are one of the few materials that are not recoverable at this time. As part of the circuit board, they are sent to a smelter for precious metal recovery, but the ceramics themselves are not recovered during this process. As new technologies and uses for recovered materials develop, a more circular economy for electronics will continue to emerge.

Every individual, business, and municipality has a part to play in sustainable management of used electronics. To ensure the electronics you no longer use are properly sanitized of data and follow the circular economy model of reuse–recovery, entrust them to an R2 Certified facility. R2 Facilities undergo comprehensive annual audits to ensure they are following the best practices established in the R2 Standard. Learn more about R2 and sustainable management of electronics at https://sustainableelectronics.org.

Fossil fuels	530 lbs (240 kg)
Chemicals	48 lbs (22 kg)
Water	1.65 tons (1.5 tonnes)
Total	**3,885 lbs (1,762 kg)**



The amount of resources it takes to manufacture a single computer and screen weighs more than a black rhinoceros.

About the author

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R2 Standard—a call to action

The R2 Standard was developed in response to the growing challenges surrounding safe and sustainable management of used and end-of-life electronics. In 2005, the U.S. Environmental Protection Agency convened a multistakeholder process to create a voluntary, market-based mechanism for ensuring best practices in electronics recycling. What emerged from that process was the "Responsible Recycling practices for Use in Accredited Certifications Programs" (R2) Practices. First published in 2008, the R2 Standard set the industry bar for responsible electronics recycling.

A revision to the Standard (R2:2013) was released in 2013, with greater emphasis on testing and repair of used electronics. The positive impact of R2:2013 was twofold. In addition to the environmental benefits of extending the life of reusable products, responsible reuse has provided tremendous social benefits by helping to bridge the digital divide around the world through making affordable used devices accessible to people without the resources to purchase new products.

The most recent version of the Standard, R2v3, released in 2020, goes even further in raising the global bar with enhanced requirements for data security, traceability, downstream accountability, legal compliance, and environmental health and safety.

The R2 Standard continues to grow worldwide, with almost 1,000 R2 Certified facilities operating in 32 countries.

Sustainable Electronics Recycling International (SERI) is a 501(c)3 nonprofit organization and is responsible for the development and oversight of the R2 Standard. Through the R2 Certification Program and other initiatives, SERI works to create a world where electronic products are reused and recycled in a way that promotes resource preservation, the well-being of the natural environment, and the health and safety of workers and communities. Learn more about R2 and sustainable management of electronics at www.seriR2.org.

US continues exploring ways to reduce reliance on critical minerals amid COVID-19 pandemic

By Lisa McDonald

Even as the COVID-19 pandemic majorly affected industries around the world, the United States government continued researching ways to reduce reliance on foreign sources for critical minerals, as described in the annual United States Geological Survey *Mineral Commodity Summaries* report.[1]

The *Mineral Commodity Summaries* spotlights the events, trends, and issues that took place the previous year in the nonfuel mineral industry. Every August the *ACerS Bulletin* provides a look at some of the key facts covered in the report, which includes statistics on production, supply, and overall market for more than 90 minerals and raw materials.

In 2020, the estimated total value of nonfuel mineral production in the United States decreased by 2% from 2019 to $82.3 billion. The total value of industrial minerals production decreased as well, by 4% to $54.6 billion. Of this total, $27.0 billion came from construction aggregates production. Crushed stone accounted for the largest share of total U.S. nonfuel mineral production value in 2020 with 22%.

Last year saw decreases in consumption of nonfuel mineral commodities in the commercial construction, oil and gas production, steel production, and automotive and transportation industries due to the financial impacts of the global COVID-19 pandemic. For the metals sector, the aluminum, iron ore, steel, and titanium industries were particularly affected by reduced demand from manufacturing. In general, mines were not subject to COVID-19-related stay-at-home orders because they were deemed critical industries, but decreased demand from downstream industries resulted in reduced production at some operations.

The United States implemented additional import duties in 2020 for certain products that were derivatives of aluminum and steel articles. These duties continued for most countries as a result of the U.S. Department of Commerce findings in 2018 of harm to national security under section 232 of the Trade Expansion Act of 1962. Likewise, the European Union imposed additional duties on approximately $4 billion of imports from the United States while China imposed additional tariffs on approximately $77 billion of U.S. imports.

In February 2020, the U.S. Geological Survey published a new methodology[2] to evaluate the global supply of and U.S. demand for 52 mineral commodities for 2007–2016. It identified 23 mineral commodities—including aluminum, antimony, bismuth, cobalt, gallium, germanium, indium, niobium, platinum-group metals, rare-earth elements, tantalum, titanium, and tungsten—as posing the greatest supply risk for the U.S. manufacturing sector. On September 30, Executive Order 13953 was issued to address the national emergency described.[3]

The U.S. continues to rely on foreign sources for raw and processed mineral materials. In 2020, imports made up more than one-half of the U.S. apparent consumption for 46 nonfuel mineral commodities, and the U.S. was 100% net import reliant for 17 of those. Fourteen of the 17 mineral commodities with 100% net import reliance were listed as critical minerals, and 14 additional critical mineral commodities had a net import reliance greater than 50% of apparent consumption.

On the next two pages, an infographic summarizes some of the salient statistics and trends for a handful of mineral commodities that are of particular interest in the ceramic and glass industries. Readers are encouraged to access the complete USGS report at https://doi.org/10.3133/mcs2021.

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USGS MINERAL COMMODITY SUMMARIES

BAUXITE AND ALUMINA

Leading producer

Bauxite: Australia flag
Alumina: China flag

End use industries
Abrasives, cement, chemicals, proppants, refractories, slag adjuster in steel mills

Trend in global production
2.3% increase for alumina; 3.6% increase for bauxite

U.S. production
1.3 million tons of alumina

U.S. import/export
>75% net import reliance for bauxite; 49% net import reliance for alumina

World reserves
55 to 75 billion tons of bauxite

BORON

Leading producer

Turkey flag

End use industries
Glass, ceramics, abrasives, cleaning products, insecticides, insulation, semiconductors

Trend in global production
Cannot be calculated

U.S. production
Withheld

U.S. import/export
Net exporter

World reserves
Adequate

CEMENT

Leading producer

China flag

End use industries
Construction

Trend in global production
No change

U.S. production
89.0 million tons of cement; 79.0 million tons of clinker

U.S. import/export
15% net import reliance

World reserves
Raw materials are abundant

CLAYS

Leading producer

Kaolin: United States flag
Bentonite: United States flag

End use industries
Tile, sanitaryware, absorbents, drilling mud, construction, refractories, paper, absorbents

Trend in global production
1.8% decrease for bentonite; 3.8% increase for Fuller's earth; 0.7% decrease for kaolin

U.S. production
25.0 million tons (49.0% common clay; 18.8% kaolin; 17.6% bentonite; 14.5% other)

U.S. import/export
Net exporter

World reserves
Extremely large

FELDSPAR

Leading producer

Turkey flag

End use industries
Glass, tile, pottery

Trend in global production
No change

U.S. production
420,000 tons (marketable production)

U.S. import/export
13% net import reliance

World reserves
More than adequate

GALLIUM

Leading producer

China flag

End use industries
Integrated circuits, optoelectronic devices

Trend in global production
14.5% decrease

U.S. production
none (primary)

U.S. import/export
100% net import reliance

World reserves
Estimate unavailable

GRAPHITE (NATURAL)

Leading producer

China flag

End use industries
Brake linings, lubricants, powdered metals, refractory applications, steelmaking

Trend in global production
No change

U.S. production
none

U.S. import/export
100% net import reliance

World reserves
>800 million tons

INDIUM

Leading producer

China flag

End use industries
Flat-panel displays, alloys, solders, semiconductors

Trend in global production
7.0% decrease

U.S. production
none

U.S. import/export
100% net import reliance

World reserves
Estimate unavailable

IRON AND STEEL
Leading producer: China

End use industries
Construction, transportation (auto), machinery, equipment, energy

Trend in global production
6.3% decrease for pig iron; 3.2% decrease for raw steel

U.S. production
18 million tons of pig iron; 72 million tons of steel

U.S. import/export
12% net import reliance

World reserves
Not applicable

KYANITE
Leading producer: South Africa

End use industries
Refractories, abrasives, ceramic products, foundry products

Trend in global production
Cannot be calculated

U.S. production
85,000 tons

U.S. import/export
Net exporter

World reserves
Significant

LITHIUM
Leading producer: Australia

End use industries
Batteries, ceramics, glass, grease

Trend in global production
4.7% decrease

U.S. production
Withheld

U.S. import/export
>50% net import reliance

World reserves
Significant

NIOBIUM
Leading producer: Brazil

End use industries
Steel industry, aerospace alloys

Trend in global production
19.6% decrease

U.S. production
none

U.S. import/export
100% net import reliance

World reserves
More than adequate

RARE EARTHS
Leading producer: China

End use industries
Catalysts, ceramics, glass, metallurgical alloys, polishing

Trend in global production
9.1% increase

U.S. production
38,000 tons (bastnaesite and monazite concentrates)

U.S. import/export
100% net import reliance for compounds and metals; net exporter of mineral concentrates

World reserves
Relatively abundant in earth's crust, but minable concentrations less common

SODA ASH
Leading producer: United States

End use industries
Glass, chemicals, distributors, soap, detergents

Trend in global production
8.5% decrease

U.S. production
9.7 million tons

U.S. import/export
Net exporter

World reserves
Practically inexhaustible

TITANIUM DIOXIDE (PIGMENT)
Leading producer: China

End use industries
Paints, plastic, paper, catalysts, ceramics, coated textiles, floor coverings, inks, roofing granules

Trend in global production
Not available

U.S. production
1.0 million tons

U.S. import/export
Net exporter

World reserves
Estimate unavailable

YTTRIUM
Leading producer: China, Myanmar

End use industries
Abrasives, bearings and seals, high-temperature refractories, jet engine coatings, metallurgy, phosphors

Trend in global production
Not available

U.S. production
Not available

U.S. import/export
100% net import reliance

World reserves
Reserves are adequate, but worldwide issues may affect production

ZEOLITES (NATURAL)
Leading producer: China

End use industries
Animal feed, odor control, water purification, absorbent, fertilizer, pesticide

Trend in global production
0.9% increase

U.S. production
88,000 tons

U.S. import/export
Net exporter

World reserves
Estimate unavailable