

CERIUM OXIDE AND TRADE TENSIONS

Insights from Industry Experts on the U.S.-China Tariffs



AMERICAN
PRECISION OPTICS
MANUFACTURERS
ASSOCIATION

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Cerium oxide is a crucial polishing compound in the optics industry due to its exceptional ability to smooth and refine glass surfaces.

Its high chemical reactivity with silica-based materials enables efficient material removal while minimizing surface damage. The compound can be processed with various particle sizes, purity content, and concentration, allowing for meticulous control over precision polishing and fast bulk removal in more commercial applications. Cerium oxide provides fast polishing speeds, durability, and excellent surface quality, making it a preferred choice for US manufacturers producing lenses, mirrors, and precision optics.

China, the leading global supplier of rare earth elements such as cerium oxide, has previously implemented export restrictions on these critical materials. These policies, often influenced by geopolitical factors and resource management strategies, have affected global supply chains. In 2010, limitations on cerium oxide exports contributed to price fluctuations and supply shortages,

impacting industries like optics, electronics, and automotive manufacturing. In response, companies explored alternative sourcing strategies, including increased recycling efforts and the use of substitute materials.

Currently, there are no specific trade restrictions affecting the export of ceria or other rare earth elements used in polishing. However, as of February 2025, trade tensions between the United States and China have escalated, marked by rising tariffs. On February 1, 2025, President Donald Trump announced new tariffs, including a 25% tariff on imports from Canada and Mexico and an additional 10% tariff on imports from China, citing national security concerns as well as issues related to illegal immigration and drug trafficking. On March 3rd, 2025 there was another 10% increase on imports from China, possibly increasing the overall price of raw cerium by 45% to suppliers in the United States.

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APOMA is fortunate to have two experts in cerium on its board of directors.



Mitzi Brennan
GENERAL MANAGER,
NORTH AMERICAN SALES



Chris Russell
SENIOR FIELD
APPLICATION ENGINEER

Mitzi Brennan from Pureon and Chris Russell from Universal Photonics both possess extensive experience in the optics sector and serve as essential suppliers of cerium oxide and various polishing consumables. In individual interviews, we inquired about their perspectives on the recently introduced tariffs and the potential for cerium oxide to be utilized as a political bargaining tool once more. Their insights were both excellent and reassuring, as detailed below.

“ trade tensions between the United States and China have escalated, marked by rising tariffs ”

LEE: What is cerium oxide and why is it important to the optics industry?

▶ **MITZI:** Cerium is a chemical element extracted from the earth alongside other rare earth elements. It was first identified in 1803 in Sweden, where it was isolated from a mineral known as cerite. After being separated from other rare earth elements and assessed for particle size and purity, cerium is utilized in the optics industry for polishing purposes. The term cerium oxide describes the reaction that occurs when cerium interacts with oxygen. Cerium oxide exhibits both mechanical and chemical properties that help to soften and smooth the surface layer of glass. Although various compounds were employed for polishing until the 1940s, cerium oxide emerged as a superior polishing agent in the 1950s.

▶ **CHRIS:** The chemical reaction of hydrolysis allows for an ion exchange that removes and smooths material more easily than other compounds. Iron oxide, chromium oxide, and zirconium oxide were all previously used, but cerium became the standard after World War II as it provided excellent results and was found to be less expensive than the alternatives. With its effectiveness spanning almost all glass types, cerium is extremely important in precision optics industry.

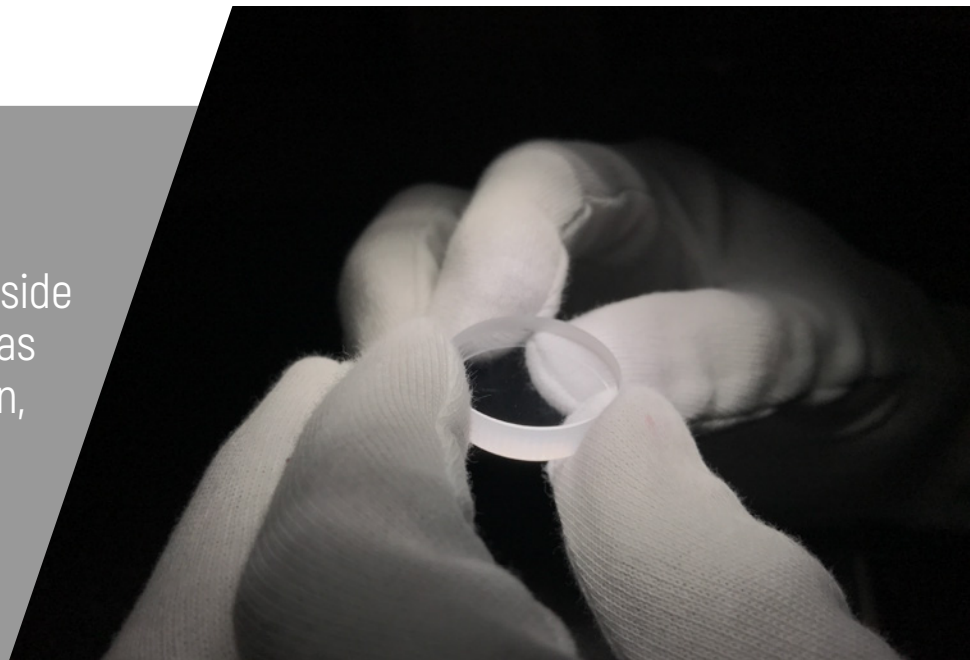
“ The benefit of cerium oxide is that it polishes a broad spectrum of glass types. ”

LEE: Does hydrolysis occur with all optical glass types, or just fused silica?

CHRIS: The most reactive glass type is fused silica; however, hydrolysis does occur with all other glasses. For sensitive glasses that may be doped with other reactive elements, the hydrolysis can be so aggressive that pitting or hazing can occur on those surfaces.

▶ **MITZI:** The benefit of cerium oxide is that it polishes a broad spectrum of glass types. It has the ability to remove scratches, imperfections, and subsurface damage for more than fused silica. Cerium has been used in the semiconductor market for years. Additionally, it can be used with a urethane pad, pitch, or any other polishing process and is effective on many glasses.

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LEE: Where does cerium oxide come from?

▶ **MITZI:** China certainly dominates the ceria market, but as rare earths continue to grow in importance, there is an increasing awareness of cerium deposits in Australia and the United States. The situation in Ukraine is particularly interesting right now, as it's reported that there are deposits of rare earth minerals within the country. The United States wants to be involved in the development of those mines, possibly exposing a new supply chain for cerium.

▶ **CHRIS:** For a short period of time the United States had an operating rare earth's mine called Molycorp, located in California. There were high hopes for cerium veins, but the mine had environmental and financial challenges. Separating the rare earth elements is a nasty process with high costs. Mountain Pass purchased what remained of Molycorp, but also failed to create a successful mining business. Now owned by MP Materials, the mine operates on a small scale, but holds source potential. Other countries with known rare earth mines are Australia, India, Greenland, and Canada.

LEE: In 2010 we saw China restrict the exportation of rare earths, particularly cerium oxide. As these trade wars continue to drive rising tariffs with China, are either of you worried about a change in US accessibility to cerium oxide?

▶ **MITZI:** It's important to remember that there is a difference between an embargo and a tariff. In 2010 we experienced an embargo where China restricted the exportation of rare earths, limiting our supply. What we're seeing now is a tariff, which is a taxation imposed by our government that increases the cost of the product but doesn't restrict it. Pureon is a global company with our geopolitical eyes wide open, and are not seeing a change in supply of cerium. Our company operates with a diverse supply chain and continues to manage and stock inventory as we feel is reasonable considering the situation.

▶ **CHRIS:** In the past China limited the amount of total rare earths being exported by weight, that was a true embargo that effected not only the optics industry, but also the automotive industry and battery dependent electronics. This situation is strictly financial right now, and there continues to be no short supply of cerium oxide. Universal keeps a good supply of cerium on hand, and we remain flexible with various sources – if the pricing from China gets too high with the tariffs, we can consider acquiring raw materials from alternative countries. We will continue to monitor the situation with our team in China, but see no supply issues on the horizon.

“ This situation is strictly financial right now, and there continues to be no short supply of cerium oxide. ”

LEE: Besides cerium, are there any other options for polishing compounds in the optics industry?

▶ **MITZI:** There are many particles that could technically polish glass, but to what specification? Alumina and diamond can be an aggressive mechanical polishing solution more suitable to a bulk removal step. Alumina is also primarily coming from China and may be facing similar tariffs. Zirconia and colloidal silica could be options. Colloidal silica provides material removal and good surface quality, but process will be slower than with cerium. Polishing processes can be modified for optics to rely on less cerium if truly needed. Stepping down diamond grinding could result in a near polished surface that requires minimal cerium for finishing results. If cerium supply becomes restricted, there are alternative polishing particles or compounds that can be used, and the best solution may be to combine the alternative materials with process adaptations.

▶ **CHRIS:** 100%. Diamond, iron oxide, and zirconia are commonly used alternatives. The chemical reaction isn't the same, so polishing times may be longer than with cerium oxide, but companies are still able to achieve high quality surfaces on glass.

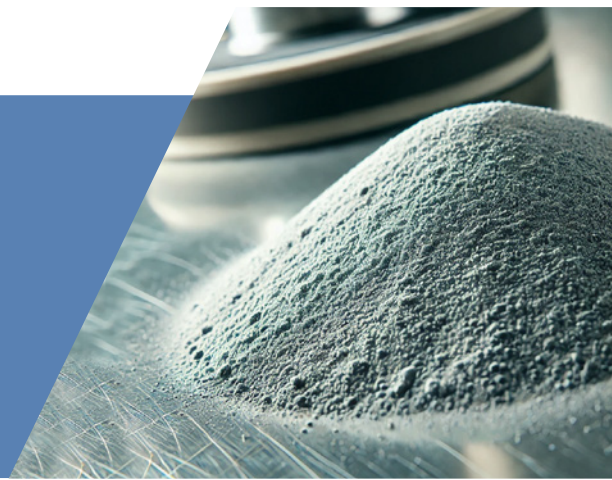
LEE: I've heard that manufacturers can reclaim cerium oxide. Is this a viable option for sustainability, if necessary?

▶ **MITZI:** It could be an option as the technology does exist, however the cost of ownership needs to be considered for this to be a viable alternative. There are some optics manufacturers that have gone through the process of reclaiming cerium in their process successfully, but many logistics needed to be worked out. How was the polish collected? What was the volume? Where and how did the reclamation process occur? How effective was the reclaimed particle in the customer's process? With every reclaimed batch of cerium oxide, it's important to note that the slurry would need to be supplemented with new and fresh ceria particles. Reclamation can potentially prolong slurry life. If we were to see tariffs continue to rise significantly, reclaiming cerium could be an option to explore.

▶ **CHRIS:** There are two factors to look at when we're talking about repurposing cerium oxide. Number one, is cost. Reclaiming any fine particulate can be extremely costly, and as long as we can continue to obtain unused cerium oxide, reclamation really isn't worth the expense. The second factor is swarf. Swarf is what we call the ground glass, polishing pad, and other waste or residue from the polishing process. It's difficult to effectively remove that swarf during the filtering process, because all the particles end up being around the same size as the ceria, or in some cases even smaller. Without all those "contaminants" removed; our customers polished optics will have an inferior surface roughness compared to surfaces obtained with fresh cerium.

We see success with reclamation when we look at companies that use multiple tons of cerium oxide per month, but for the US optics manufacturers, reclamation only makes sense if the price of cerium increases by tenfold.

“If cerium supply becomes restricted, there are alternative polishing particles or compounds that can be used”



LEE: Chris, we're talking about the possible increase in price as it relates to polishing compounds, but are there other product lines or consumables that may be affected by these tariffs?

▶ **CHRIS:** Many of our customers use polishing pads that are impregnated with cerium. Should Universal be unable to accommodate the increasing tariffs, there would also be a corresponding small rise in the price of these pads. Cerium, along with other rare earth elements, is commonly utilized as a dopant in various optical glasses to modify their optical properties or to enhance their resistance to harsh chemicals. Lanthanum glass, radiation absorbing glass, and neodymium-doped glass are some examples. Depending on where these glasses are made, pricing may increase if impacted by the tariffs.

LEE: Mitzi, how do you see the price of cerium being impacted in the next 6-12 months?

▶ **MITZI:** Pureon is actively researching and analyzing the situation with scenario planning. Our supply chain is global, and we will continue to work at making sure the pipeline of raw materials is flowing smoothly. We encourage our customers buy only what you need. We are monitoring the situation very cautiously to ensure we maintain supply. As we replenish our raw material inventory of ceria, the cost to procure will increase due to tariffs.

LEE: Thank you, Mitzi. Last question...if we get 400 impressions on LinkedIn, will you bake cookies for our APOMA General Meeting at OptiFab?

▶ **MITZI:** Absolutely! Baking is something that I enjoy, and I'd be happy to bake cookies based on the success of this conversation!

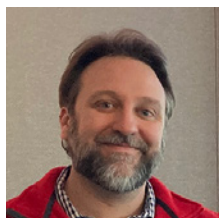
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CONCLUSION

While the recent U.S.-China tariffs have raised concerns about rising costs, APOMA board members and industry experts Mitzi Brennan and Chris Russell provide reassurance that the supply of cerium oxide remains stable. Unlike the 2010 embargo that restricted exports, the current situation is a financial challenge rather than a supply chain crisis. Acquiring cerium on an as-needed basis is crucial, as manufacturers aim to avoid inadvertently increasing prices by prompting suppliers to restock cerium without necessity. Additionally, options like cerium reclamation and substitute polishing compounds remain on the table should costs begin to rise.

We extend our gratitude to both individuals for their dedication and efforts in educating and reassuring our members as we navigate through these tariff-infested waters. We encourage our members to engage with us by providing feedback or raising questions regarding this matter. The politics and proportioned tariffs are changing regularly. Should the industry experience any shifts, APOMA stands prepared to offer support and guidance to our esteemed optics manufacturing members.



ABOUT THE AUTHOR

Lee Steneken is a former president of APOMA, having served on the board for eight years. He is the CEO of Esco Optics, a leading manufacturer of custom and catalog optics based in Oak Ridge, New Jersey.



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