Material Name: Zircopax

Etymology:

Brand name for zirconium silicate mixture.

Zircon: < German Zirkon (A. G. Werner Cronstedts Versuch einer Mineralogie (1780) 162), probably an alteration of German †Cerkonier colourless zircon (1773 or earlier, usually with plural agreement; also as Circonier , Zerkonier , Zirkonier), itself apparently an assimilated borrowing < Italian (now archaic and rare) giargone , giarcone , zargone , gergone (14th cent., plural giargoni ; compare jargon n.2) < Old French, Middle French jacunce , jargunce jacounce n.

(OED, “zircon n.”)

Uses in studio ceramics:

Zircopax is a brand name of zirconium silicate (or zircon). It is primarily used in ceramics to opacify glazes. In North America, the most popular zirconium opacifiers fall under the brand names of Zircopax Plus, Superpax, Zircosil and Excelopax. These vary according to particle size, the finer the size the greater the scattering of light (and thus the better the opacification). In addition, the finer-sized materials contain a little extra silica for maximum whiteness.

Of course, the amount of zircopax in a glaze determines the opacity. Small amounts (1-3%) may give no noticeable difference but are sometimes employed to improve glaze hardness. Since zircopax is refractory, the more that is added the more the degree of glaze melting (and melt viscosity) is going to be affected. Up to 15% or more might be needed to fully opacify a glaze. If higher amounts are needed the glaze formulation may need to be adjusted to reduce the amount of SiO2 or increase flux (to melt the glaze better).

Zircopax affects glaze melt viscosity, surface smoothness, thermal expansion and color development and can be implicated in a range of glazes faults associated with these. Please read the page on zircon for more information.

Zirconium prices are have increased rapidly in recent years, reflecting the world supply situation. Even though the material is very expensive, Zircopax is added to the body recipe of “porcellanato” tiles. It is a very effective body whitener, especially for casting porcelain. Excessive additions give the porcelain an artificial "white plastic" appearance. (DigitalFire, “Zircopax”)

Other Uses:

“Zircon flour is manufactured by milling zircon sand, usually in ball mills, either in the dry state or in a slurry.

It is used in a variety of applications, including ceramic frits, foundry mould coatings, ceramic shells for investment casting, refractories, friction products, insulating fibres and glass.

Depending on the application, there are various specifications for particle size, typically -200 mesh (-75 µm) and -325 mesh (-45 µm).
Zircon flour is packaged in bulk bags or paper sacks, or delivered in tankers (as powder or slurry/slop).
Zircon flour is used in the ceramic glaze, glass, refractory and plastics industry. It is ideal for use as an opacifier for glaze frits. Small additions of zircon can help to improve the mechanical strength of glass and impart alkali resistance to the glass fibres used in glass reinforced concrete. Zircon flour can also be used as a refractory wash for glost kilns, as a fine constituent in pressed zircon refractory shapes and, as filler for epoxy resins. Finely-milled zircon, 'zircon flour', is also used in refractories and friction products."
(Zircon Industry Association, "About Zircon: Zircon Flour")

"The major end uses of zircon are refractories, foundry sands (including investment casting), and ceramic opacification. Zircon is also marketed as a natural gemstone, and its oxide is processed to produce the diamond simulant, cubic zirconia. Zirconium is used in nuclear fuel cladding, chemical piping in corrosive environments, heat exchangers, and various specialty alloys. The major end uses of hafnium are in nuclear control rods, nickel-based superalloys, nozzles for plasma arc metal cutting, and high-temperature ceramics."
(USGS, "Zirconium and Hafnium Statistics and Information")

Source Location and Extraction Process/Conditions:

UNCONFIRMED WITH COMPANIES, BUT VERY LIKELY:

Chemours, mine just east of Starke, FL: 5222 Treat Rd, Starke, FL 32091

"Prior to mining, the trees may be harvested and the land is cleared. The topsoil is stockpiled for use during reclamation. The overburden (earthen material that will not be sold) is removed and stockpiled along the edge of the mining area. The overburden may be used to contain sediment and stormwater within the mine. After mining is complete, the topsoil and overburden may be used in reclamation for slopes and revegetation.

Heavy minerals occur as sand grains mixed with lighter clays and quartz sand grains. Within the ore body, less than 5% of the grains may be heavy minerals. Two mining methods are used: suction dredging and auxiliary mining.

Suction Dredging: An electrically powered suction dredge floats within a 15- to 20-acre man-made pond. The dredge draws in overburden, ore and water from one end of the pond and transfers the mixture to a floating wet mill. Vibrating screens remove roots and other large objects. Spiral centrifuges concentrate and separate the heavy mineral sands from the lighter clays and quartz sand. The 80% heavy mineral concentrate is pumped to a stockpile area before being transported to a plant for further processing. The tailings of clays and quartz sand is discharged back into the pond behind the suction dredge.

As the dredge moves forward, the area behind the dredge is recontoured, covered with topsoil, and revegetated to meet reclamation standards.
Auxiliary Mining: This method is used in locations that are not suitable for suction dredging. The topsoil and overburden is removed with earth moving equipment and stockpiled for later use in reclamation. The ore layer is loaded on to trucks and hauled to an area in front of the suction dredge or to a mobile mining unit.
At the suction dredge, the ore is processed as described above. At the mobile mining unit, over-sized material including roots, rocks and hardpan are removed. The remaining material is mixed with water and pumped to a modular concentrator for separation. Tailings from the suction dredge or the modular concentrator are pumped back into the auxiliary area to backfill the mined-out pits. The auxiliary areas are then backfilled with overburden, recontoured, covered with topsoil, and revegetated to meet reclamation standards."
(Florida Dept. of Environmental Protection, "Heavy Minerals")

According to USGS, the US imports substantial amounts of zirconium silicate, so Trebol hypothetically could be receiving their materials internationally. In lieu of communication with them, I've assumed they're sourcing this material domestically.

Refinement Process:

"Chemours mines zircon sands from mineral sands deposits in the southeastern United States, then chemically scrubs the sands to produce clean products that are free of dirt and ultrafines that could damage substrates. They are then calcined to reduce water and other volatile content. The sands are separated from other minerals by physical processes to produce uniform high-quality products."
(Chemours, "Zircon Sands")

Distribution Journey:

****Changed to table format to show possibility of multiple possible source mines, distribution hubs, etc. Can add or subtract locations depending on actual number steps in the distribution journey.**

Location 01 (source mine(s) etc.)	**Location 02**	**Location 03**	**Location 04**	**Location 05**
Chemours Mine: 5222 Treat Rd, Starke, FL 32091	Trebol warehouse: 11400 New Berlin Rd, Jacksonville, FL 32226	Laguna Clay: 14400 Lomitas Ave, City of Industry, CA 91746:	Rocky Mountain Clay: 1220 W 1st Ave, Denver CO 80223	CSU Art Dept: 551 W Pitkin St, Fort Collins, CO 80523

UNCONFIRMED, POSSIBLE: Dupont Mine: 7775 County Rd 228, Macclenny, FL 32063				
UNCONFIRMED, POSSIBLE: Southern Ionics Mine: 31° 01’ 21” N, 81° 58’ 09” W				

Geologic Origins:

Most likely similar to EPK’s geologic story

Oldest rocks in the area of Chemours mine are 490 feet deep and Eocene in age. (FSGS Report, 1977)

Land Acknowledgement:

Timucua

National Park Service webpage

Broad and diverse collection of peoples lumped into Europeans’ convenient and incorrect name for them

Extinct

Synopsis:

Zircopax or Zircopax Plus is a brand name for the mineral zirconium silicate, also known as zircon. Zircon is a variant of an old Germanic word meaning colorless, likely referring to this material’s unique appearance.

Zircopax Plus is mainly composed of refined zirconium silicate with small amounts of additional crystalline silica added to it. In the ceramic world, Zircopax is primarily used to opacify glazes and is a very effective body whitener, especially for casting porcelain.
Industrially, zircon flour, which is just milled or refined zircon sand, is added to friction products and abrasives, and in small amounts it contributes mechanical strength to glass and alkali resistance to the glass fibers in glass-reinforced concrete. Zircon flour also goes into the molds for investment casting, and zirconium, which is a metal, plays a part in many speciality alloys.

Zirconium dioxide, also called cubic zirconia because of its molecular structure, appears identical to diamonds and is sold as a diamond simulant.

Zircon is a coproduct of heavy mineral sands mining, which aims to harvest other minerals for their titanium content. The Chemours Company operates a heavy mineral sands mine in north-central Florida. This was historically the territory of a diverse scattering of many distinct communities that Europeans erroneously referred to as a singular Timucua people. The heavy mineral sands in Florida have their geologic origins somewhere in the Tertiary or early Pleistocene, between 50 and 2 million years ago.

Heavy mineral sands are generally mined through either wet or dry processes, both being very similar. In the wet process, also called suction dredging, the raw material is sucked with water through a machine that deposits the slurry into a man-made pond where it is screened and separated through spiral centrifuges into an 80% heavy minerals stockpile. This stockpile is then transported to a facility for further processing. The dry method, also called auxiliary mining, is used whenever the wet method cannot work; it is essentially the same as the wet method except that the raw material is brought to the suction machine from elsewhere.

Chemours mines and processes the zircon sands at its mine near Starkes, Florida before transporting the material to a broker named Trebol in Jacksonville. From there, the zircon goes to Laguna Clay in California before going to Rocky Mountain Clay in Denver, where it ultimately ends up at Colorado State University. In total, this material travels 3,551 miles from mine to studio.

Bibliography/Sources:

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Research Process:

I started with zircon's etymology, then moved on to its studio ceramics. I reached out to RMC about Zircopax Plus and they told me that they get this material from Laguna. I looked at

Laguna's SDS sheet for Zircopax Plus and found the company Trebol based out of Florida. I tried calling several numbers associated with this company and didn't get anywhere. From here I decided to do some deducing (if that's the right word), read into zirconium production in the US and found the USGS's data sheet on this material; turns out "In 2021, one company recovered zircon (zirconium silicate) from surface-mining operations in Florida and Georgia as a coproduct from the mining of heavy-mineral sands and the processing of titanium and zirconium mineral concentrates." From here, I Googled "zircon mining companies Florida" and came across Chemours' website where I was able to see that they have a history with titanium (world's largest titanium oxide producer) and actively market their Zircon sands products. After this, I googled "heavy mineral sands in Florida" and found their Dept. of Environmental Protection website where they had a map with heavy mineral sands localities in four counties in northern Florida. Then I browsed around on Google Maps and zoomed in on anything that looked like a mine, and this is how I found Chemours' mine just east of Starke as well as Dupont's mines and also Southern Ionics' mines. I decided Chemours' mine looked like the only one recently mined, which is consistent with USGS's data. Assuming Trebol sources their zirconium silicate domestically and not internationally, I felt confident with source locations and browsed around the Internet for human interest stories related to this material.

Additional Notes, Research, etc.:

-USGS stat sheet on Zirconium

-Zircon Industry Association: "Zircon, also known as zircon silicate ($ZrSiO_4$), is found in ancient mineral sand deposits. In the form of crystal sands, zircon is typically brown, but could also vary from colourless to yellow-golden, pink and red to blue and green.
Zircon is one of the two core product streams from 'mineral sands', the other being titanium minerals (ilmenite, leucoxene and rutile).
The majority of zircon sand is mined in Australia and the African continent. Current annual global production is in excess of one million tonnes. Almost half of the zircon produced globally is consumed by China, with other significant consuming regions including Europe, North America, Asia-Pacific and India.
The main use of zircon sand is its conversion into flour, opacifier, fused zirconia, zirconium chemicals, chemical zirconia and zirconium metal. Zircon sand is directly used in foundry applications and refractories and other minor applications.

-Industrial Mineral Forums and Research, 2015 article about zircon sand mining in US
Dupont, Southern Ionics, Iluka major producers in US, Iluka phased out
No mention of Chemours (??)
"The foundry market – where zircon is used in foundry sand, coatings, and stucco– is one of the main markets for zircon, vying for a market share of 10-15% along with chemicals and refractories. Demand from investment casting in the automobile and aerospace sectors is growing.

Ceramics is the largest market for zircon, accounting for about 51-55%. The total world market for zircon is about 1m tonnes."

-Cubic Zirconia vs. Diamonds

Different than zirconium silicate; zirconium dioxide

Cubic crystalline shape makes it a diamond lookalike