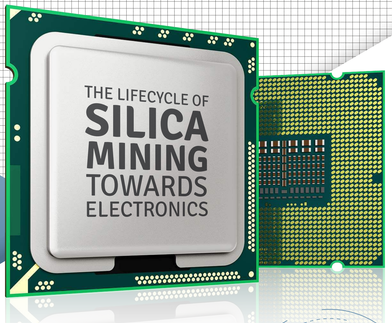
MOSIMTEC™

FROM MINE TO MOTHERBOARD

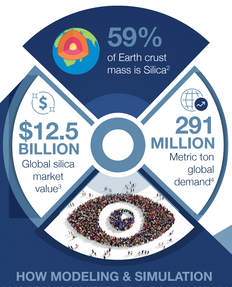


WHAT IS SILICA?

Silica is one of the most common substances on Earth. It's a type of sand consisting mostly of silicon dioxide (SiO_2), making it a prime source of silicon (Si). Since silicon is never found in its natural state, silica has become an important commodity. Each year, **7.2 MILLION** 1 metric tons of silicon are extracted and processed.

WHAT IS SILICA USED FOR?

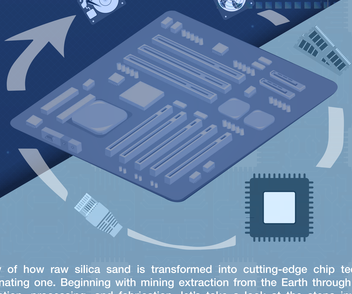
Silica and silicon are used in steel alloys to improve strength, aluminum processing casting and welding, chemical products such as lubricants and moisture barriers, and ceramics. However, its superconductor properties make it an extremely attractive material for computer chips and solar cells.



HOW MODELING & SIMULATION ENGINEERING (MSE) AIDS SILICA MINING, TRANSPORTATION, AND PROCESSING

Today's computer simulation modeling capabilities allow organizations to develop, validate, verify and analyze their processes before they're put in place. From using dynamic simulation techniques to plan workflows at mines to designing the most efficient transportation logistics imaginable, MSE paves the way for the journey from mine to motherboard.

THE JOURNEY OF SILICA FROM MINE TO MOTHERBOARD



The story of how raw silica sand is transformed into cutting-edge chip technology is a fascinating one. Beginning with mining extraction from the Earth through storage, transportation, processing, and fabrication, let's take a look at the steps involved in computer chip creation - and how the process is aided by modeling & simulation engineering.

STEP 01

MINING

Silica is obtained via open pit or quarry mines using standard mining equipment. As the process usually begins as sand, it's relatively easy and cost-effective to extract. **Dynamic simulation software is used to help mine owners proactively envision their workflows and pre-determine how equipment from mining vehicles to belts and hoists will interact for maximum efficiency.**

STEP 02

STORAGE/WAREHOUSING

Once extracted, the silica sand is moved to an onsite storage facility prior to being transported to processing facility. Depending on the mine's constraints, the storage facility may be located off site. **MSE aids in silica sand storage by envisioning the optimal layouts and workflows for warehouse and storage facilities.**

STEP 03

TRANSPORTATION

Silica sand may be transported to a processing facility via several modes: by road, rail, or barge. In all cases, federal safety regulations require strict compliance and include provisions for load management and containment since spills can damage the environment and pose a health risk. **Simulation tools aid in the best deployment of truck, rail, barges, and ships by analyzing cost, schedule, service levels and maintenance to allow producers to optimize for margins.**

STEP 04

PROCESSING

During processing, the silica is refined by extracting the oxygen fromthe $SiO2$ silica, then mixing it with carbon and heating it to beyond 2,000 degrees, resulting in 99% pure silicon - which is still insufficient for chip makers. The silicon is subsequently put through a secondary refining process by grinding it, mixing it with hydrogen chloride, heating it again, resulting in a liquid that is distilled to 99.9999% pure silicon ingots. **Simulation software enables silica processing by predicting failures, identifying constraints, balancing production lines and selecting material replenishment strategies to maximize throughput.**

STEP 05

FABRICATION

The ingots are then precision cut into fine silicon discs called "**wafers**". These wafers go through a sophisticated polishing process until they are completely smooth. The finished, polished wafers are ready to form the basis of a microchip. **CAD drawings and 3D animation are used to simulate and visualize the fabrication process to ensure optimal performance and flawless production workflows.**

STEP 06

CHIP MANUFACTURE

Finally, the chip manufacture process turns the polished ingot into a working microchip. A painstaking and precise series of steps are involved, starting with using photolithography to imprint light-sensitive patterns onto it. Ions are then embedded to improve conductivity; the light-sensitive patterns are removed, circuits are etched, and metals are added through electroplating to connect the transistor components. After testing, the chip is ready to be packaged and shipped. **Chip fabrication takes advantage of MSE to visualize production process, test scheduling algorithms, and balance demand from competing products to execute flawlessly for maximum ROI.**

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RESOURCES

1. https://www.statista.com/topics/1959/silicon/
2. https://www.britannica.com/science/silica
3. http://www.pitandquarry.com/global-demand-for-silica-sand-reported-to-increase/
4. http://www.pitandquarry.com/global-demand-for-silica-sand-reported-to-increase/
5. http://www.techradar.com/news/computing-components/processors/how-sand-is-transformed-into-silicon-chips-599785