

MINERAL HEATING AND COOLING FOR DOWNSTREAM PROCESSES

Mineral heating and cooling is an important step in some mineral processing operations. Accurate and even temperature profiling is an important step when heating, cooling or drying minerals to ensure the success of downstream processes and a quality final product. Newer indirect heat exchanger technologies allow more accurate temperature profiling while requiring less energy and space than conventional technologies.

What are minerals?

Minerals are described as solid, inorganic, naturally occurring substances, varying in colour, hardness, density, size, transparency and composition. Common minerals include aluminum, the most abundant metal found in the Earth's crust, cobalt, copper, feldspar, iron ore, nickel, silica and zinc. Rocks containing minerals or metals that can be recovered for industrial processes or profit are known as ores.

Minerals are part of our daily lives. Minerals such as phosphate, potash and lime are used in agricultural fertilizer, having positive effects on soil improvements. Silica sand plays an important role in the production of different packaging for many consumer products. Many construction materials originate from minerals such as clay used to make brick, slate for roofing tiles, copper for plumbing and wiring, silica sand for glass and gypsum for plaster and concrete. Even the energy sector relies on minerals such as coal for power and heat.

How are minerals processed?

In general, minerals processing follows similar steps regardless of type of mineral. The first step is to separate the minerals from the waste materials through crushing and screening. Crushing can be done in different stages, using different machinery to achieve varying degrees of granularity. Screening separates different sized minerals for downstream applications. The next step is known as comminution, which is another size reduction of the solid material to a consistent particle size for further processing. Further grinding, separation and classification can also be done at this stage. Enrichment is the process of improving the quality of minerals by removing impurities; this can be done by washing.

In some cases, thermal processing or thermal drying is required to remove low water content in the mineral particles. For the success of many downstream processes and the final application of minerals, accurate and even temperature profiling is an important step when heating, cooling or drying minerals. A challenge within the industry is the abrasive nature of minerals, these highly dense and erosive particles can cause degradation and extensive wear on technologies used during thermal drying.

What technologies can be used for thermal processing of minerals?

Common technologies used for thermal processing and drying of minerals are rotary drums, steam tube dryers and fluid bed dryers. However, these traditional technologies require high energy consumption due to the input of air or steam required to directly cool, heat or dry mineral particles, resulting in inefficiencies. Due to inconsistent mass flow principals of these traditional technologies, the mineral particles do not dry evenly to a stable final temperature, resulting in lower quality minerals at output.

Indirect heat exchangers are a relatively new technology to mineral processing, using the principals of thermal dynamics to heat, cool and dry mineral particles via conduction. To ensure consistent heat transfer, mineral particles move at a low velocity downwards between stainless steel, hollow plates. Hot or cool liquid flows countercurrent within the plates, heating, drying or cooling the minerals via conduction. The final output temperature will be even and accurate across all mineral particles. As there are no air requirements in this process, the need for fans, blowers and associated air handling equipment is eliminated and energy consumption is significantly reduced compared to rotary drums and fluid beds. Indirect heat exchangers are suitable for handling high temperature mineral processes, up to 2000°C, and are not damaged by the highly abrasive mineral products. Indirect heat exchangers can increase capacity while ensuring accurate temperature profiles, improving downstream processes within the minerals processing industry.

To find out more about Indirect Heat Exchangers and Mineral processing, visit: <http://solexthermal.com/heat-exchanger-applications-and-industries/minerals-and-sands/>

