The world's purest vanadium oxide

SCHUBERT SALZER

Precise steam regulation by sliding gate valve stabilises variations in temperature

An application report by Ben Davis, John Herida with MIC Sales Inc. and Donnie Anderson

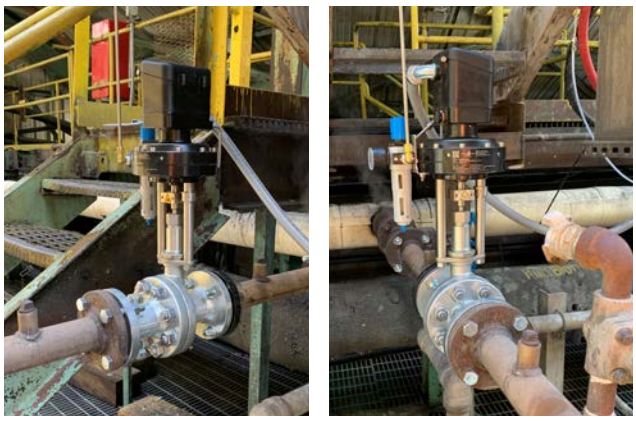
Almost 200 years ago, the Swede Nils Gabriel Sefström discovered a new element. Inspired by the rich colouring of its chemical compounds, he called it "vanadium" after Vanadís (Freyja), the Scandinavian goddess of beauty. Today, the world's purest vanadium compounds are manufactured on an industrial scale by U.S. Vanadium. Sliding gate valves help to reach and maintain the optimal process temperature.

U.S. Vanadium, based in Arkansas, USA, is one of the leading manufacturers and suppliers of vanadium compounds. Steel alloyed with vanadium is used in bridges, buildings and car parts, in the aerospace industry, in ships and pipelines, and in many other industries. As a result, lightweight construction is possible. It can make an important contribution to increase resource efficiency in these areas.

However, U.S. Vanadium is known above all for the compounds vanadium pentoxide (V_2O_5) and vanadium trioxide (V_2O_3) that it manufactures. According to the company, the highest degrees of purity in the world are attained in the production of the two substances. The ultra-pure compounds are used in special applications, for example in dyes and special alloys, or as catalysers in sulphuric acid production. Meanwhile, the energy transition in particular is fuelling demand, because extremely pure vanadium oxides are the crucial basic component for the operation of vanadium redox flow batteries, which can be used to store energy on a large scale in a sustainable and resource-saving way.

Ultra-pure vanadium is a recycled product

A large number of industrial waste products, such as slag from the steel industry, serve as the basic material for the manufacture of vanadium oxides. This is finely ground and oxidised with sodium salts to produce water-soluble compounds of sodium and vanadium. To leach these from the slag with maximum efficiency, the suspension is heated to exactly 95 °C.



The sliding gate valve Type 8621 with flanged connection in use on the steam line at U.S. Vanadium. The overall length corresponds to that of a globe valve of the same nominal size.

In the past, variations in temperature frequently occurred in this continuously running process. The optimal temperature of 95 °C is very difficult to reach and maintain precisely due to the constantly supplied and deviating input quantities of the suspension. To solve this problem and increase efficiency, U.S. Vanadium has now tested one of the first USA-made flanged sliding gate valves type 8621 at a central point in the process.

"Commissioning the valve could not have been any easier. The positioner is self-adjusting. Once the supply air and electrical connections are made, simply initiate the self-adjustment. The valve's sliding gate design made installation a breeze due to the fact a smaller actuator is sufficient to control the valve, thus making the overall size more compact.", Ben Davis – Process Controls and Project Manager at US Vanadium.

This is due to the basic physical principle on which the valves are designed: two slotted discs that slide over each other and seal against each other. The actuator only has to overcome the sliding friction between the two discs over a valve stroke of just ¼ - ½ inch. The required actuating force is up to 90 percent lower than with other valve designs, which is why it is possible to use signif-

icantly smaller actuators. Despite the same overall length, sliding gate valves are therefore much more compact in design and are easier to handle than comparable globe valves.

„This smaller actuator is also beneficial in terms of energy cost. The shorter stroke and reduced force needed to shut-off or control the valve results in less air needed to actuate the valve.", explains Davis. "We installed this valve in a steam line that is used to heat a 50,000 gallon tank of slurry where we leach vanadium. This is a continuous process with 100-140 gallons per minute of cold slurry going in, and the same amount going out. The leach slurry in the tank is maintained at 95 °C during this process."

After a short time, it was already clear that the replacement of the previously installed globe valves had a beneficial effect on the process and could improve the efficiency of the manufacture of extremely pure vanadium oxides. „The new valve has given us tighter control of heat energy into the process, which allows us to match heat energy required for incoming cold slurry, and therefore reduces temperature oscillations.", says Davis.

Good prospects for the energy change

The demand for the extremely pure vanadium oxides from U.S. Vanadium has grown considerably due to the energy change. Vanadium redox flow batteries are scalable almost without limits as energy storage devices and have a long service life with 15,000 – 20,000 charge and discharge cycles. U.S. Vanadium is therefore working continuously to increase the efficiency of the process and to lower operating costs still further. A new plant for manufacturing the electrolytes for the vanadium redox flow batteries has now gone into operation directly next to the vanadium oxide production plant. U.S. Vanadium can therefore now cover the entire supply chain for ultra-pure vanadium electrolytes.

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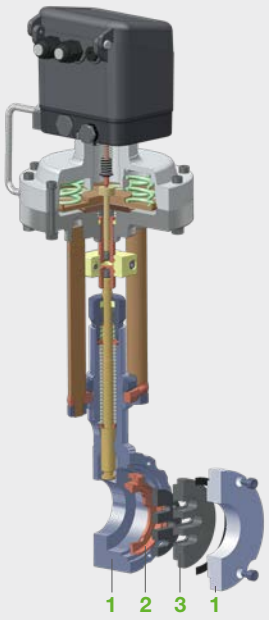

Functionality of Sliding Gate Valves:

A sealing plate (**2**) fixed in the housing (**1**) perpendicular to the direction of flow has a defined number of transverse slots (**3**) of the same size. A rotationally fixed disc (**4**) with the same arrangement of slots is moved vertically and thus changes the flow cross-section. The subsequent pressure difference presses the moving disc (**4**) onto the fixed disc (**2**).

About U.S. Vanadium LLC

U.S. Vanadium LLC produces and sells a range of specialty vanadium chemicals, including what it claims is the highest-purity Vanadium Pentoxide ("$V_2 0_5$") in the world. The company is comprised of global leaders and investors in the specialty chemicals and strategic materials sectors, including in the mining, processing, purification, and sales and distribution of vanadium specialty chemicals.

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