Demand for vanadium in the automotive industry, a double-edged sword

A transformation within the automotive industry toward electrification is taking place as sustainability concerns accelerate the demand for electric vehicles (EVs). This is causing the internal combustion engine (ICE) to lose market dominance. This global shift towards decarbonised mobility, in a bid to help slow climate change, is expected to disrupt the automotive supply chain but will also provide major opportunities across all vehicle segments.

In terms of overall use in vehicle manufacturing, steel is one of the most widely preferred automotive materials. This is mainly due to its design flexibility, cost effectiveness and recyclability.

As such, steel will continue to be the automotive material of choice due to the ever-evolving nature of the steel industry, which continues to develop stronger, lighter weight yet more formable products.

As automakers are required to adapt to global electrification trends and environmental pressures, so too has the steel industry had to change to meet the evolving needs of the automotive industry.

The automotive industry's need for higher strength steel, specifically advanced high-strength steels (AHSS) and high-strength low-alloy steels (HSLA) has resulted in a increase in demand for vanadium.

Vanadium contributes to the strength and economic efficiency demanded in materials for vehicles. Materials used in vehicles must be strong, reliable, easy to manufacture and give the highest strength-to-weight ratio to minimise fuel consumption and be available at minimum cost.

Around 90% of vanadium is used as an alloying element in steel and is the most used microalloying element in high strength air-cooled forgings for automotive components in the drivetrain and chassis of cars and trucks, such as crankshafts, connecting rods and steering knuckles. It is also used in automotive hot and cold rolled strips to increase strength and improve ductility.

Vanadium is added to a wide range of automotive steels, including dual phase, twinning-induced plasticity and transformation-induced plasticity, precipitation hardened ferrite pearlite, press hardened, hot formed, bainitic, ferritic and martensitic steels, to increase the strength of these steels but also to make these steel easier to cast and roll.

Electrification is expected to lower the demand for automotive components used only in ICE vehicles such as conventional transmissions, engines and fuel injection systems while demand for certain chassis components, powertrain parts and thermal management components used in EVs are expected to increase as a result of electrification.

Global management consulting firm, McKinsey & Company, projected that worldwide demand for EVs, including battery electric vehicles, plug-in hybrid electric vehicles and fuel cell electric vehicles, will grow sixfold from 2021 through 2030. Unit sales are expected to increase from 6.5 million to roughly 40 million over that period.

Further, McKinsey outlined that new regulatory targets in the European Union and the United States are seeing countries target an EV share of at least 50% by 2030, with several other countries also announcing accelerated timelines for ICE sales bans in 2030 or 2035. Moreover, some automotive OEMs have noted their intention to stop investing in new ICE platforms and models, with many declaring specific dates at which they planned to end ICE vehicle production.

While the global shift away from ICE vehicles to EVs would require fewer forged engine components, it would require high strength steels for vehicle bodies. This is because customers worldwide are demanding safer cars and governments are more strictly regulating collision safety ratings.

Despite the broad use of vanadium in automotive components, the growing demand for EVs means that the market for some vanadium-containing forging steels used for ICE vehicle components such as crankshafts and conrods will decline in the medium term.

Conversely, the demand for vanadium in AHSS for use in vehicle bodies is expected to grow on increased EV demand, possibly due to the high strength-to-weight ratio of stronger steels. Higher strength steels can also be used to improve the crash test safety standards of EVs, owing to the heavy weight of an EV battery.

Despite shifts in the use of vanadium in steel, Vanitec, the not-for-profit international global member organisation whose objective it is to promote the use of vanadium-bearing materials, estimates that demand for vanadium in steel will increase at a CAGR of 2.7%, reaching 136,000 tonnes in 2030.

According to David Crowther, technical consultant at Vanitec, it is critical that steel companies employ the latest steel production technologies, to enable them to reduce production costs and produce the most technologically advanced steels demanded by customers. As steel production technologies continue to develop, it is vital that vanadium alloyed steels can be adapted for production using these latest technologies.

This could be an area of continued future demand growth for vanadium as new developments are made in advanced high strength steels, says Crowther.