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Argus White paper:

ELECTRONIC METALS DEMAND Spotlight on 5G technologies

Mobile telecom service providers are expected to invest heavily between 2018 and 2020 in capital expenditure, much of that on the deployment of highspeed network infrastructure. WHAT DOES THIS MEAN FOR ELECTRONIC METALS MARKETS?

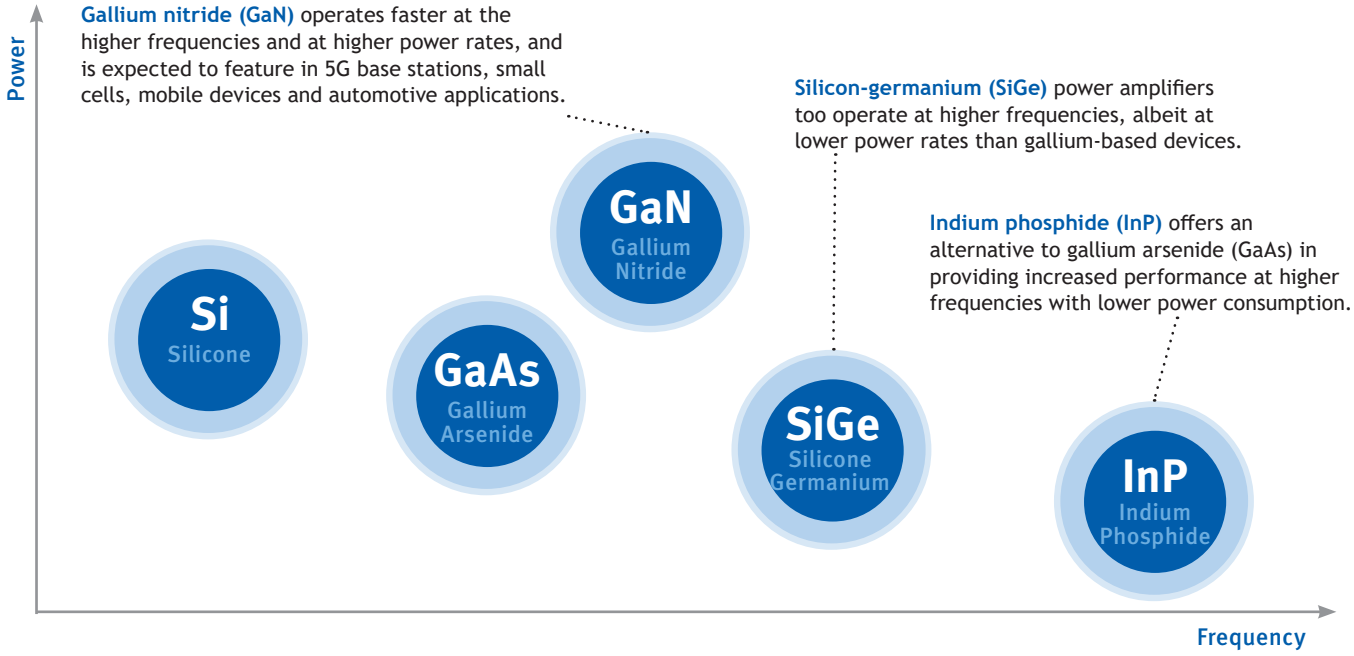
Technology innovations to drive electronic metals demand

The convergence of technology and communications in next-generation networks is creating new applications for metals including indium, gallium and germanium in electronic devices, reversing a decline in consumption led by increased design efficiency.

The rollout of fifth-generation (5G) wireless telecom networks around the world is increasing demand for communications equipment that can run at higher speeds and increased efficiencies over wider bands of radio spectrum. The next billion or so Internet-connected mobile devices, along with rising data usage and the adoption of cloud storage, require a ramp up in the deployment of superfast broadband services that can handle large volumes of data transfer.

Those requirements are driving a switch towards the use of new metal compounds in semiconductors, to achieve higher performance than some older silicon-based technologies.

Figure 1: Relative performance of semiconductor compounds



Metals
illuminating the markets

In the previous generations of mobile connectivity, the core fixed-line telecom network connects to base stations that transmit and receive signals to and from mobile devices. This process creates latency, or lag time, in the responsiveness of the network to a device. That becomes evident in the "buffering" of streaming video on a smartphone. But 5G networks will be less centralised, as operators will use software technologies to control functions and infrastructure will be installed more densely at a local level, reducing latency. Low latency opens up the possibility of widespread use of data-intensive applications like virtual reality and autonomous vehicles.

The high frequency waves used in 5G networks have shorter ranges than the low-frequency signals in 4G networks, and the need for a higher proportion of base stations will result in the deployment of a large number of small cells rather than a small number of large masts. That will in turn require a larger volume of semiconductor materials. The arrival of 5G technologies and associated applications has the potential to absorb some of the global oversupply that has developed in the electronic metals markets in recent years.

Consumption of these highly specialised metals in semiconductor materials has fallen as component design has become increasingly efficient. Devices have been using smaller volumes of metal even as they achieve higher performance.

DID YOU KNOW?

The Fanya Metal Exchange reported holding 3,609t of indium in its warehouses —equivalent to 4.4 years of annual global production. It held 92t of germanium and 191t of gallium — close to a year of global production for each.

Electronic metals markets chronically oversupplied

Production of metals used in electronic devices is highly concentrated in China, with some output in North America and Europe.

Chinese gallium production has climbed in recent years in line with the growth of its alumina output, which increased by 16.1pc between 2006 and 2016, according to the China Non-ferrous Industry Association (CNIA). Around 95pc of Chinese gallium output is a by-product of alumina, with the remaining 5pc coming from lead and zinc ores.

Following the adoption in 2010 of resin technology to increase recovery rates, Chinese gallium production rose to 500t by 2014 from 100t previously, according to CNIA. The subsequent oversupply weighed on prices and producers dropped output to around 200t in 2017.

DID YOU KNOW?

5G networks will operate across multiple layers of radio spectrum: 2-6GHz to balance coverage and capacity; millimetre wave bands above 24Ghz for high data rates and below 1GHz for coverage across urban and rural areas.

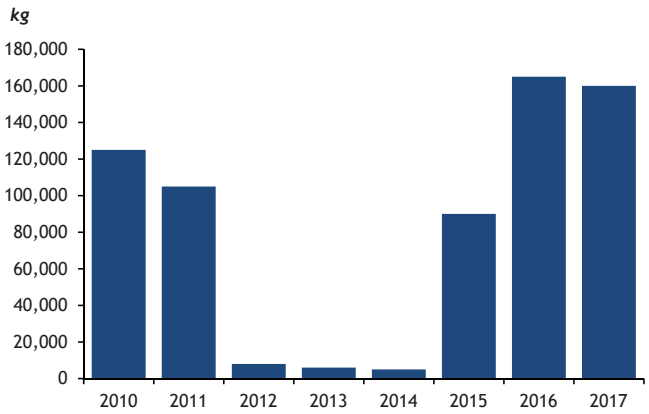
The 900t global indium market shifted when the China-based Fanya Metal Exchange absorbed domestic production, and output outside China increased to make up for the loss of exports. The collapse of the exchange in 2015 subsequently led to the resumption of exports and global oversupply.

Production of germanium metal has outpaced demand, prompting suppliers to use their output to make refined materials that sell for higher prices. Chinese producers have been operating at around half of their combined 200t of metal capacity. A new production line came into operation in China in 2017 to produce germanium tetrachloride for use in fibre optics, for which demand has been rising.

A lack of high-volume demand has weighed heavily on spot market prices for some metals used in electronic devices. In 2017, the European market for 99.99pc grade gallium metal fell to its lowest level since the assessment was launched in 2002. Prices for 99.99pc grade indium metal fell to 14-year lows and prices for 99.999pc germanium metal were at seven-year lows.

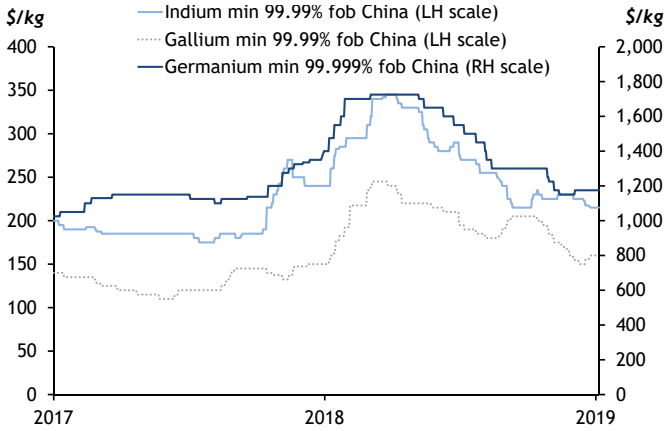
There was little buying interest from key consumers in the electronics sector, as slow global economic growth reduced demand for new products. Developed markets for electronics have become largely saturated, with most households owning a range of mobile devices, computers and televisions.

Figure 2: Chinese annual indium exports



But prices for all three metals rose to three-year highs earlier this year as traders and investors began to stockpile material, in expectation that demand for new technologies will lift the markets in the next year.

Figure3: Spot prices for Chinese exports



Network rollouts underway

There are more than 9bn mobile telecom connections globally, belonging to more than 5bn subscribers. Not all of those connections include access to the Internet, but the number of mobile Internet users is expected to increase by 1.75bn to reach 5bn by 2025, according to telecom industry group GSM Association.

Mobile telecom service providers are expected to invest $479bn between 2018 and 2020 in capital expenditure, much of that on shifting customers to high-speed networks. A total of 67 telecom operators in 39 countries have announced plans to launch 5G services by 2022, according to the GSM Association.

By 2025, 53pc of mobile connections will operate on 4G networks and 14pc will operate on 5G, the GSM Association estimates. The number of Internet of Things (IoT) connections is set to increase to 25bn by 2025 from 7.5bn in 2017.

Following preliminary tests in the past few years, the first large-scale trial networks were launched earlier this year including in China, Qatar, South Korea, and Spain, and deployed in cities in the US and UK in October.

US-based manufacturers of semiconductor materials — including AXT, Qorvo, and Texas Instruments — expect demand for 5G network equipment to drive sales growth in 2019 and 2020, the target for telecom providers to roll out fully commercial services.

And network equipment makers including Ericsson and Nokia are banking on the installation of new 5G base stations to increase sales, with the global radio access equipment market recovering from several years of negative growth. US-based ON Semiconductor says that new applications are driving the semiconductor sector, rather than macroeconomic conditions and industry cyclicality.

5G-enabled "Internet of Things" and connected electric vehicles

The adoption of 5G networks will not only deploy new network equipment; it will enable the proliferation of a range of new Internet-connected mobile devices, home appliances and electric vehicles (EVs) — all of which will further increase demand for minor metals.

Applications include:

- High-speed mobile broadband
- Cloud computing
- Connected devices
- Augmented/virtual reality
- Security and surveillance
- Smart home appliances
- Smart power grids
- Electric vehicle features
- Traffic management
- Healthcare technologies
- Logistics tracking
- Industrial automation

The need for high performance at higher temperatures in new equipment will expand the use of indium soldering for wires and components. Widespread adoption of smart technology is expected to increase consumption of indium tin oxide (ITO) and indium gallium zinc oxide (IGZO), which are used in LED flatpanel display and touch screens. Those screens will appear on everything from EV dashboards to home appliances.

EV dashboard screens cover much larger areas than their predecessors, enabling a range of features including graphical displays of vehicle functions, battery status and entertainment apps. Some car models feature additional screens for the back seats, for personal video viewing and in-car controls.

GaN transistors will feature in electric vehicles in three key ways: enabling wireless power transfer for the mobile devices controlling the apps in the connected car; offering high-speed resolution for the sensors, cameras and image processors in assisted and autonomous driving; and increasing voltage for electric motor propulsion. SiGe chipsets similarly enable radar functions in advanced driving systems.

The low latency and high data transfer rate of 5G networks not only connect the inside of the car, but make vehicle-to-vehicle (V2V) communication viable. V2V transmissions would include information about the location, speed and direction of vehicles to provide alerts about nearby hazards. V2V could be expanded to vehicle-to-everything (V2X), to allow the vehicle to communicate with traffic lights, pedestrians, cyclists and the network, to potentially reduce accidents.

Smart technology and the availability of higher data capacity will likely also encourage the development of other applications that have so far not been possible.

DID YOU KNOW?

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