

## RESEARCH NOTE

# China restricts exports of critical metals used in semiconductors and solar panels

JULY 6, 2023

On July 3, China published a notice restricting the export of certain key metals used in the production of advanced semiconductors and solar panels.<sup>1</sup> Issued by the Ministry of Commerce, the directive targeted two types of critical metals: gallium and germanium,<sup>2</sup> both on the country's national strategic mineral list. China produces over 80 percent of gallium and 68 percent of germanium and their alloys worldwide.

However, these metals differ from the rare earth metals whose global reserves are concentrated in China. In the case of gallium and germanium, other countries can turn to recycling and their own reserves in the short run, as the Chinese export restrictions start to bite. In the long run, other producing countries are likely to increase their outputs as demand pushes up prices. Thus, China may not enjoy a long-term international advantage from the new export ban, as global supplies diversify, although domestic semiconductor firms might be incentivized to produce more advanced chips.

Gallium is critical in the making of certain types of high-speed and energy-efficient chips. Although silicon-based chips are used in most of the world's semiconductor devices and integrated circuits, the physical properties of silicon materials limit their use in optoelectronics and high-frequency, high-powered devices. Gallium and other materials are well suited for so-called later generation semiconductors, which can overcome some of these challenges and excel in harsher conditions. It is used to produce high-performance microwave and millimeter-wave devices and light-emitting devices, which makes it promising for defense, aviation, aerospace, oil exploration and optical storage purposes. Gallium nitride can reduce energy loss by more than 50 percent and greatly reduce the volume of equipment required, compared to silicon-made components, making it suitable for sustainable energy consumption.

Beijing's highly-anticipated notice is a retaliation against the United States' efforts to restrict Chinese capacity to manufacture advanced chips. Early this year, Japan and the Netherlands rallied behind the White House to restrict exports of numerous technologies cru-

cial for chip design and production. The American strategy is meant to choke China's progress in the AI race, which has great ramifications in the fields of the military, the economy and more.

Chinese telecommunications equipment, such as base stations, used to be extremely dependent on imports, especially from the U.S., which monopolizes the making of high-power radio frequency devices. In February 2023, ahead of further expected decoupling, China Telecom built its first completely homegrown base station that provides 5G services. In automotive electronics, Chinese-produced semiconductors are becoming increasingly mature, while many types of chips (i.e., MCU, NOR Flash, IGBT) are being localized. Domestic manufacturers are emerging to produce high-performance computing chips, or AI chips, with firms like Cambrian Technology, HiSilicon, REEXEN, SemiDrive, Deepview, Horizon Robotics, and Bitmain leading technological breakthroughs.<sup>3</sup> China is now moving at an impressive pace in producing its own advanced semiconductors, but still faces a considerable gap with the U.S.

A top producer of the two critical metals, the Chinese firm Chalco has a gallium production capacity of about 200 tons per year, and made 146 tons of gallium in 2022. The company's stock, along with that of six other public companies making the targeted metals, spiked on news of the export notice.<sup>4</sup> Chinese media<sup>5</sup> has argued that the policy will stimulate the industry chain upstream, and that the domestic market share of gallium-related compounds could be higher in the future. For midstream chip makers, the restrictions encourage the making of gallium wafers in China to lower production costs. For downstream companies, the announcement builds the confidence to continue investing in the communication, defense and military sectors.

1 <http://www.mofcom.gov.cn/article/zwgk/gkzcfb/202307/20230703419666.shtml>

2 The list also includes gallium nitride, gallium oxide, gallium phosphide, gallium arsenide, indium gallium arsenide, gallium selenide and gallium antimonide, as well as phosphorous germanium zinc.

3 <https://search.iczhiku.com/public/weixin1544441463591.html>

4 <https://www.stcn.com/article/detail/909344.html>

5 <https://m.yicai.com/news/101798370.html>