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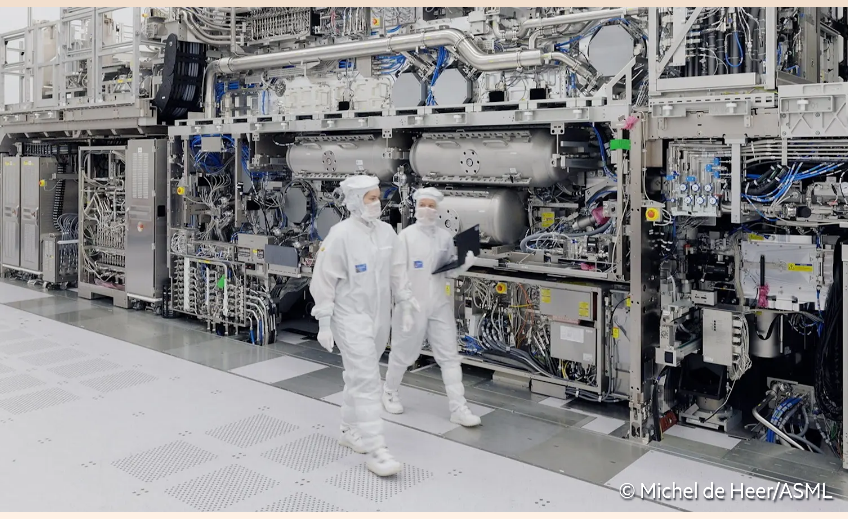
Huawei drives China's push to make its own advanced chips

华为推动中国自主制造先进芯片

Tech giant plays 'project management' role to build components needed for DUV machines and avoid export controls

这家科技巨头扮演"项目管理"角色，推动制造 DUV 设备所需组件，以规避出口管制



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Eleanor Olcott in Beijing and **Zijing Wu** in Hong Kong

北京的 Eleanor Olcott 和香港的 Zijing Wu

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Huawei is at the centre of a drive to eliminate foreign technology from China's semiconductor supply chain by backing companies developing components for machines that can produce the most advanced chips.

华为正处于一项推动中国半导体供应链摆脱外国技术的行动核心，通过支持开发可制造最先进芯片的设备组件的企业，助力实现这一目标。

The Chinese tech giant is investing across the industry behind making lithography chipmaking equipment, while helping secure deals with leading Chinese fabs such as SMIC, as it seeks to build a domestic alternative to foreign suppliers, according to multiple people familiar with the matter.

据多位知情人士透露，这家中国科技巨头正在投资光刻芯片制造设备产业链，同时帮助与中芯国际等中国领先晶圆代工厂达成交易，以寻求建立外国供应商的国内替代方案。

One of the most significant efforts involves Yuliangsheng, a Shanghai-based chip equipment manufacturer that has co-developed the first Chinese-made advanced deep ultraviolet lithography (DUV) machine, according to people familiar with the matter.

据知情人士透露，其中一项最重要的行动涉及总部位于上海的芯片设备制造商裕良盛，该公司共同研发了首台中国制造的先进深紫外光刻（DUV）设备。

Yuliangsheng has been spun out from SiCarrier, a start-up that the FT has previously reported has close technical and business ties to Huawei. Huawei has denied any affiliation with SiCarrier.

裕良盛从 SiCarrier 分拆而来。英国《金融时报》此前报道称，这家初创企业与华为在技术和业务方面关系密切。华为否认与 SiCarrier 存在任何关联。

The DUV machine is being tested by Chinese chipmakers including SMIC and on Huawei's own production lines, the people said. Its makers are targeting the machine to eventually make advanced AI chips, but it is being tested on less complex semiconductors as engineers improve the device.

消息人士称，包括中芯国际在内的中国芯片制造商以及华为自有生产线正在测试这台 DUV 光刻机。其制造商的目标是最终利用该设备生产先进 AI 芯片，但目前正在测试复杂度较低的半导体，以便工程师改进设备。

Lithography remains one of the biggest obstacles to China's push for semiconductor self-sufficiency. Local chipmakers still rely heavily on the Netherlands' ASML for the equipment needed to manufacture advanced semiconductors, while domestic alternatives lag on critical components including projection lenses and high-powered light sources.

光刻仍是中国推动半导体自主发展的最大障碍之一。中国本土芯片制造商在很大程度上仍依赖荷兰 ASML 提供制造先进半导体所需的设备，而国内替代方案在投影镜头和高功率光源等关键部件方面仍然落后。

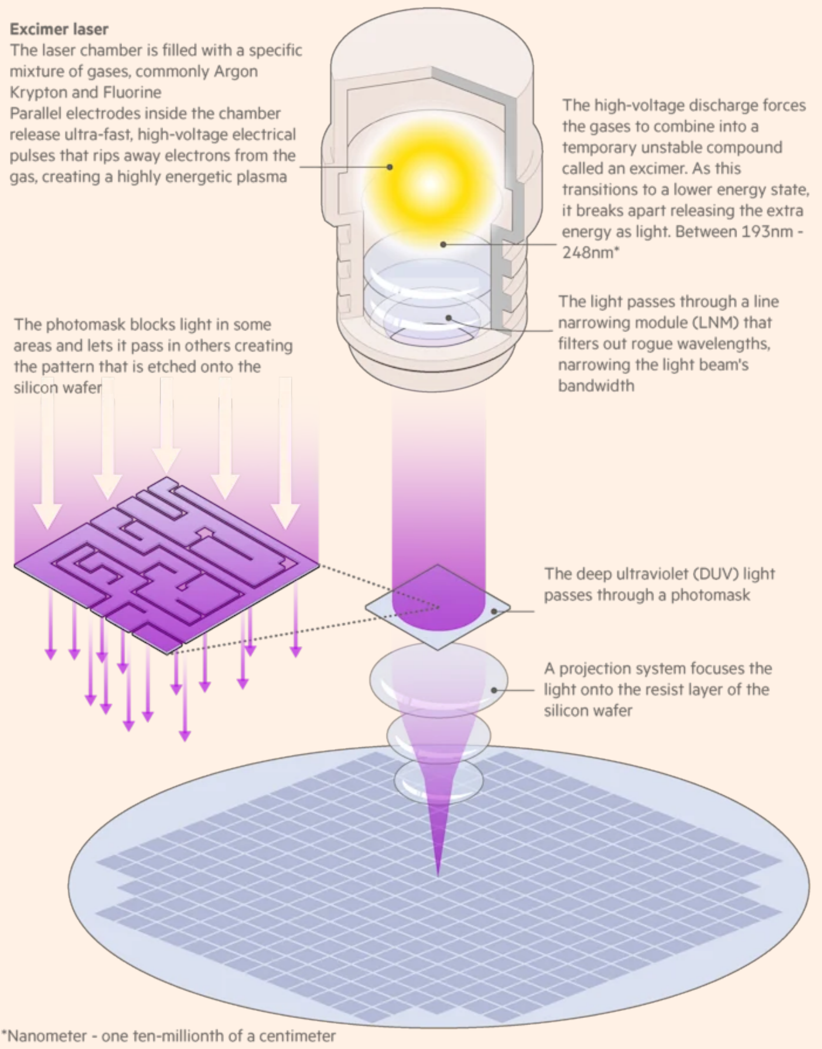
Huawei is seeking to close those gaps by backing local suppliers and helping push their equipment into commercial fabs, where years of testing and refinement are needed before domestic machines can compete with established foreign equipment. Success would also leave China less vulnerable to western export controls.

华为正通过支持本土供应商，并帮助推动其设备进入商业晶圆厂来弥补这些差距。在国产设备能够与成熟的外国设备竞争之前，商业晶圆厂需要进行多年的测试和改进。成功还将使中国更不易受到西方出口管制的影响。

"Huawei is playing a project management role in China's DUV push," said Lin Qingyuan, a semiconductor analyst at Bernstein. "Simply having a DUV prototype is not enough. You need thousands of vendors and customers to work together to push it forward and a central orchestrating power to bring this effort together."

“华为在中国推进 DUV 方面发挥着项目管理作用，”Bernstein 半导体分析师林清远表示。“仅有一台 DUV 原型机是不够的。你需要数千家供应商和客户协同合作，推动这项技术向前发展，还需要一个居中协调的力量，将这项努力整合起来。”

General principles of deep ultraviolet lithography


Excimer laser
The laser chamber is filled with a specific mixture of gases, commonly Argon Krypton and Fluorine
Parallel electrodes inside the chamber release ultra-fast, high-voltage electrical pulses that rips away electrons from the gas, creating a highly energetic plasma
The high-voltage discharge forces the gases to combine into a temporary unstable compound called an excimer. As this transitions to a lower energy state, it breaks apart releasing the extra energy as light. Between 193nm - 248nm*
The photomask blocks light in some areas and lets it pass in others creating the pattern that is etched onto the silicon wafer
The light passes through a line narrowing module (LNM) that filters out rogue wavelengths, narrowing the light beam's bandwidth
The deep ultraviolet (DUV) light passes through a photomask
A projection system focuses the light onto the resist layer of the silicon wafer

*Nanometer - one ten-millionth of a centimeter
Source: FT research
© FT

Yuliangsheng is set to produce 12 DUV machines by the end of this year, according to one person familiar with the matter, although the company remains a long way from competing with

ASML.
据一位知情人士透露，裕量生计划在今年年底前生产 12 台 DUV 设备，不过该公司距离与 ASML 竞争仍有很长的路要走。

The Dutch company’s machines are essential for manufacturing cutting-edge semiconductors but western export controls prevent sales of its most advanced equipment to China.
这家荷兰公司的设备是制造尖端半导体不可或缺的工具，但西方出口管制禁止其向中国销售最先进的设备。

The FT previously reported that SMIC was testing a 28-nanometre Yuliangsheng machine and using so-called multi-patterning techniques to produce 7-nanometre chips, according to two people with knowledge of the development. In chipmaking, lower nanometre numbers generally denote more advanced generations of chips.
据两位知情人士透露，英国《金融时报》此前报道称，中芯国际正在测试一台 28 纳米的瑜亮盛设备，并采用所谓的多重图案化技术生产 7 纳米芯片。在芯片制造领域，纳米数值越低通常意味着芯片世代越先进。

Yuliangsheng’s machines will take several years to reach their ASML equivalent’s productivity level, requiring lengthy verification and fine-tuning.
瑜亮盛的设备还需要数年时间才能达到 ASML 同类设备的生产效率水平，其间需要进行漫长的验证和微调。

With the support of Shanghai Micro Electronics Equipment, a longstanding local lithography manufacturer, Yuliangsheng is developing multiple DUV prototypes. Some rely on critical foreign components, while others are testing local alternatives.

在本土资深光刻机制造商上海微电子装备的支持下，瑜亮盛正在开发多款 DUV 原型机。其中一些依赖关键外国零部件，另一些则在测试本土替代品。

DUV machines contain tens of thousands of parts across roughly a dozen major component groups. Chinese suppliers lag behind foreign rivals in two of the most complex: projection lenses and light sources.

DUV 光刻机包含大约十几个主要部件组，零部件总数达数万件。在最复杂的两类部件——投影镜头和光源方面，中国供应商落后于国外竞争对手。

Huawei’s corporate venture arm Habo, which invests in areas where China relies on foreign technology, and another Huawei-backed fund, Shenzhen Yuanzhi Xinghuo, have both backed suppliers targeting critical equipment bottlenecks.

华为旗下的企业创投部门 Habo 投资于中国依赖外国技术的领域；另一家由华为支持的基金深圳元智星火也已投资于瞄准关键设备瓶颈的供应商。

© Cheng Xin/Getty Images

Yuliangsheng uses projection lenses made by Germany’s Zeiss for its DUV machines, according to two people familiar with the matter. Zeiss said it only sold its lithography optics to ASML.

据两位知情人士透露，裕量生的 DUV 光刻机采用德国 Zeiss

制造的投影镜头。Zeiss 表示，其仅向 ASML 出售光刻光学系统。

Industry insiders said it was possible to secure the lenses on the secondary market in China.

业内人士表示，在中国二级市场上有可能买到这些镜片。

Both Habo and Shenzhen Yuanzhi Xinghuo have backed Zeiss competitor Fujian Zhiqi Photonics, an ultra-precision optics manufacturer spun out of Shenzhen-listed optical materials group Castech in 2022. In 2023, Yuanzhi Xinghuo invested Rmb100mn (about $15mn) for a 37 per cent stake.

Habo 和深圳远智星火均投资了蔡司的竞争对手福建至奇光子。该公司是一家超精密光学制造商，于 2022 年从深交所上市的光学材料集团 Castech 分拆而来。2023 年，远智星火投资 Rmb100mn（约合$15mn），取得 37%的股份。

Castech, which traces its origins to a Chinese Academy of Sciences research institute, is a leading manufacturer of optical crystals used in laser systems and has previously disclosed that ASML and Huawei are among its customers.

Castech 起源于中国科学院的一家研究所，是激光系统所用光学晶体的领先制造商，此前曾披露 ASML 和华为是其客户。

Zhiqi is developing ultra-precision optical components, including lenses that seek to displace Zeiss and which the company said have been used in “key systems of major domestic technical equipment”.

至奇正在开发包括镜片在内的超精密光学组件，力图取代蔡司。该公司表示，这些产品已用于“国内重大技术装备的关键系统”。

Another major bottleneck in China’s attempt to develop domestic lithography equipment is the light source. Japanese supplier Gigaphoton and ASML subsidiary Cymer are the dominant suppliers.

中国尝试开发国产光刻设备面临的另一大瓶颈是光源。日本供应商 Gigaphoton 和 ASML 子公司 Cymer 是主要供应商。

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“This is a key technical hurdle for China,” said Bernstein’s Lin. “Building a light source is easy, but having one that works very stably at such high power is difficult.”

“这是中国面临的一项关键技术难题，”Bernstein 的 Lin 表示。“制造光源并不难，但要让光源在如此高的功率下运行得非常稳定，就很困难了。”

Multiple industry executives pointed to progress by Beijing RSLaser Opto-Electronics, a leading developer of the type of light source used in DUV. RSLaser has also received investment from Huawei’s Habo.

多位业内高管指出，北京 RSLaser Opto-Electronics 在 DUV 设备所使用的这类光源方面取得了进展。RSLaser 还获得了华为旗下 Habo 的投资。

RSLaser has supplied light sources for older-generation DUV equipment made by Shanghai Micro Electronics Equipment, according to public disclosures. RSLaser is also working with SMEE on the light source for its 28nm DUV machine, Chinese media have reported.

据公开披露信息，RSLaser 已为上海微电子装备制造的老一代 DUV 设备供应光源。据中国媒体报道，RSLaser 还正与 SMEE 合作，为其 28nm DUV 设备开发光源。

Commercial adoption remains a problem, however. Multiple industry insiders said that while leading fabs such as SMIC have purchased and are testing Yuliangsheng’s DUV machines, they still rely on those made by ASML.

然而，商业化采用仍然是一个问题。多位业内人士表示，尽管中芯国际等领先晶圆厂已经购买并测试了上海微电子的 DUV 设备，但它们仍然依赖 ASML 生产的设备。

ASML’s sales in China continue to be robust and are projected to total a fifth of its revenue this year, despite significant stockpiling in recent years.

尽管近年来中国市场已进行了大量囤货，ASML 在中国的销售仍然强劲，预计今年将占其营收的五分之一。

Memory-chip makers CXMT and YMTC have both stocked up enough DUVs from ASML to cover their expansion plans over the next three years, according to a person with knowledge of the matter.

据一位知情人士透露，存储芯片制造商长鑫存储（CXMT）和长江存储（YMTC）都已从 ASML 囤积了足够的 DUV 设备，可满足其未来三年的扩产计划。

“Chinese DUV capabilities have improved significantly, but they are still lacking the full support of the fabs,” said Lin. “ASML is a leader today because of its collaboration with TSMC.”

“中国产 DUV 设备的能力已有显著提升，但仍未获得晶圆厂的全面支持，”Lin 表示。“ASML 如今能够成为行业领导者，是因为其与台积电（TSMC）的合作。”

He added that US restrictions could inadvertently accelerate China’s progress by forcing domestic chipmakers to work more closely with Chinese equipment suppliers. “If the restrictions push local fabs to collaborate with local DUV suppliers, they could increase their technological capabilities much faster than expected.”

他补充说，美国的限制措施可能会迫使国内芯片制造商与中国设备供应商开展更紧密的合作，从而意外加速中国的进展
“如果这些限制措施促使本地晶圆厂与本地 DUV 供
那么它们提升技术能力的速度可能会远超预期。”