



Fact sheet

EUV lithography: Five fast facts about a superlative technology

1. What EUV lithography is all about:

A microchip's life starts in a photolithography system. Most of today's systems apply ultraviolet (UV) light to create billions of tiny structures on thin silicon wafers. Collectively, these structures make up an integrated circuit or chip. The semiconductor industry's tireless quest to boost microchip performance compels chipmakers to pack even more structures onto a chip to make it faster and more powerful while driving down production costs. To do this, they need lithography systems that work with EUV light. Short for extreme ultraviolet light, EUV has a wavelength of just 13.5 nanometers. A human hair is around 30,000 nanometers thick, so that is a very narrow beam indeed.

2. How EUV lithography works:

A lithography system works much like a projector that beams light through a blueprint of the pattern to be applied to the chip. Its optics transfer this pattern to a silicon wafer coated with a chemical that is sensitive to light. The pattern emerges as the areas unexposed to this light are etched away. Working with EUV light is tricky. Everything – even air – absorbs it rather rapidly. This is why an EUV system is equipped with a large high-vacuum chamber long enough to guide the light to the wafer via an array of precision mirrors.

Generating EUV light is not easy. This requires a very powerful TRUMPF laser that can strike droplets of tin in a vacuum chamber as they shoot past to achieve a hit rate of 50,000 times a second! This generates a plasma bolt that emits light at the desired wavelength of 13.5 nanometers. Collectors then capture, focus and deliver the EUV light emitted by the plasma for the lithography system to expose the chip.

3. Why EUV lithography matters:

The technology behind conventional UV lithography systems has advanced beyond what many had thought possible. Hard-pressed to improve on the state of the art, the industry had to reach deep into its bag of tricks to shrink chips' structures. An analogy makes this point clearer: Say somebody is practicing their handwriting with a highlighter. As they write their name in smaller and smaller letters, they eventually reach for a different marker. To stick with this analogy, EUV lithography is the pen that puts finer lines within the industry's reach. Chipmakers can take advantage of this finer resolution to produce smaller, faster and more powerful chips while containing the complexity of the manufacturing process and production costs.

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4. How TRUMPF figures in this is:

ASML's huge lithography systems have what it takes to produce the latest generation of microchips. They expose these microchips with EUV. And TRUMPF has what it takes to generate this special type of light inside the lithography system – a laser that can strike 50,000 droplets of tin twice in the space of a second. The first laser shot flattens the droplet; the second atomizes it into plasma to generate this prized EUV light. Only TRUMPF's high-performance laser is able to hit 50,000 droplets per second at precisely the right moment. Shaping the light beam to this end, it generates compressed light packages that experts call laser pulses. They shoot towards the droplets, generating EUV light upon impact. No other laser on the market can do that.

5. Who makes EUV lithography systems:

The story behind EUV systems has three protagonists: TRUMPF develops and produces the laser that generates EUV light. ZEISS does the same for the high-precision optics that collect and focus this light. ASML accounts for the largest share of EUV revenue. This Veldhoven-based company makes the chamber in which tin droplets are generated and integrates the 180-metric ton system's individual components.



Mounting.jpg

Assembly and start-up a component for the TRUMPF EUV laser system in a cleanroom.
(Source: TRUMPF)



Preparation_EUV_laser.jpg

TRUMPF's high-power laser serves to generate precious EUV light inside a lithography system.
(Source: TRUMPF)

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About TRUMPF

TRUMPF is a high-tech company offering manufacturing solutions in the fields of machine tools and laser technology. The Company drives digital connectivity in manufacturing through consulting, platform products and software. TRUMPF is a technology and market leader in highly versatile machine tools for sheet metal processing and in the field of industrial lasers.

In 2019/20, the company employed some 14,300 people and generated sales of about 3.5 billion euros (preliminary figures). With over 70 subsidiaries, the TRUMPF Group is represented in nearly every European country as well as in North America, South America and Asia. The company has production facilities in Austria, China, the Czech Republic, France, Germany, Italy, Japan, Mexico, Poland, Switzerland, the United Kingdom and the United States.

Find out more about TRUMPF at www.trumpf.com

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