



— ATHANASSIOS KALIUDIS

## Behind the scenes of microchip production

**Be it smartphones with turbo data transfer and face recognition, smart data glasses, artificial intelligence or driverless cars – high performance superchips are what's needed for the megatrends of tomorrow. The key to producing these chips has three letters: EUV. A look behind the scenes at the advanced technology of EUV lithography.**

### — What EUV lithography is:

The life of a microchip starts in an optical lithography system. Today most of these systems use ultraviolet light (UV) to fabricate billions of miniature structures on thin silicon wafers. Together these structures form an integrated circuit known as a chip. The unrelenting drive of the semiconductor industry for ever more powerful microchips means that chipmakers must pack even more structures onto a chip, thereby making the chip faster and more powerful while simultaneously lowering the production costs. To do this, they need lithography systems that use EUV light. EUV stands for extreme ultraviolet light and has a wavelength of only 13.5 nanometers. A human hair in comparison has a width of about 30,000 nanometers.

### — How EUV lithography works:

A lithography system is essentially a projection system. The light is projected through a blueprint of the pattern to be transferred. The optics transfer the pattern to the silicon wafer that is coated with a light-sensitive chemical. When the unexposed part is etched away, the pattern is revealed. The tricky thing about EUV light is that it is rapidly absorbed by everything, even by air itself. An EUV system thus has a large high vacuum chamber where the light is guided by a series of ultra-reflective mirrors until it reaches the wafer.





Commissioning of a TRUMPF EUV laser system in an installation bay.

– TRUMPF



Mirror assembly in the TRUMPF clean room for production of the EUV laser system.

– TRUMPF



TRUMPF employee in the clean room assembling the EUV laser system.

– TRUMPF



EUV optics system from Zeiss.

– Zeiss



A Zeiss system grinds and polishes a mirror for EUV production.

– Zeiss



ASML employees in the clean room of the company in Veldhoven, Netherlands.

– ASML



ASML employees working on a new generation of the EUV lithography system NXE3400B.

– ASML

The biggest challenge is the fact that EUV light is difficult to generate. This is because at 13.5 nanometers we are very close to atomic dimensions. To generate EUV light, a high power laser from TRUMPF strikes the droplets of tin in a vacuum chamber as they shoot past – 50,000 times a second! It generates a plasma that emits EUV light at the desired wavelength of 13.5 nanometers. Collectors then gather the EUV light emitted by the plasma, focus and deliver it to the lithography system for the chip exposure.

— Why EUV lithography is necessary:



