

20 Years of Nanoimprint

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Until 20 years ago, nanolithography by a mechanical method was unthinkable. Not only do mechanical methods use a completely different physical principle from the traditional lithography (wave/particle interactions (e.g. photons, electrons) with matter); but also mechanical methods were perceived, at that time, to be applicable only for large scale structures, not for nanoscale.

Twenty years ago, in 1995, nanolithography by a mechanical method was demonstrated [1]. The term “nanoimprint” or “imprint lithography” was coined. The work showed 10 nm resolution patterning with high throughput --35 times smaller than the semiconductor manufacturing node of 1995 (350 nm). The 1995 work, together with follow-on development, started to change people’s perception of mechanical methods for nanoscale patterning, and opened up the field of nanoimprint and a paradigm shift in nanolithography.

Over the past 20 years, thanks to enormous innovations and contributions from the entire nanoimprint community along with government and industrial support, the field of nanoimprint has advanced enormously, making significant and unique impact on nanotechnologies and on a broad range of industries such as nanophotonics, smartphones, displays, light emitting diodes, solar cells, optical communication, semiconductor ICs, data storage, biotechnology, pharmaceuticals, medicine, and security features (banknotes, identifications), to name just a few. Nanoimprint has now grown into a multi-billion dollar industry.

The talk will present author’s experience and bird-eye view of the 20 year path that led us to today, the status, and the future of nanoimprint research and commercialization.

[1] S. Y. Chou, P. R. Krauss, and P. J. Renstrom, *Appl. Phys. Lett.*, **67** (21), 3114 (1995)

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