



DRIVING INNOVATION IN PERFORMANCE MATERIALS


Navigating the Hype Cycle

Brian Daniels
Head of Advanced Technologies Business Unit,
Merck KGaA, Darmstadt, Germany

Introduction – Brian Daniels




- Head of Performance Materials Advanced Technologies, Merck KGaA, Darmstadt, Germany from Sep 2014
- Global Director of R&D for AZ Electronic Materials Apr 2011 – Jan 2015
- Moved to Germany Dec 2014
Based in Japan Jan 2012 – Dec 2014
- Former CTO of Honeywell Electronic Materials (5 years)
- 25+ years industry experience (National Semiconductor, Seagate)
- Ph.D. in Materials Science & Engineering, Stanford

A man with brown hair, wearing a blue long-sleeved shirt and grey trousers, is sitting on a white sofa. He is holding a black remote control in his right hand and looking towards a large LCD television mounted on the wall. The television displays a soccer game with players in green jerseys. The background is a simple, light-colored wall. The image is partially obscured by a white curved shape on the left side, which contains the text.

**DO YOU
KNOW...**

... how many LCD televisions,
smartphones, tablet computers
et cetera contain display
materials from us?

A person with brown hair is lying on their stomach on a light-colored sofa, watching a television. The television is mounted on a wall and displays a soccer game with players in green jerseys. The scene is set in a living room with light-colored walls and a white lamp visible in the background.

DO YOU KNOW...


... how many LCD televisions,
smartphones, tablet computers
et cetera contain display
materials from us?

A = over 35%

B = over 60%

C = over 80%





**DO YOU
KNOW...**

... how many LCD televisions,
smartphones, tablet computers
et cetera contain display
materials from us?

B = over 60%
Liquid crystals
and reactive mesogens
(plus photoresists during
production)

DO YOU KNOW...

... how many of high-end smartphones contain „chips“ optimized by Integrated Circuit Material from us?



DO YOU KNOW...

... how many of high-end smartphones contain „chips“ optimized by Integrated Circuit Material from us?

A = over 60%

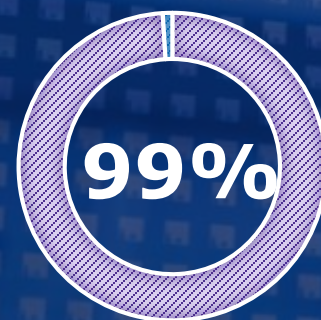
B = over 80%

C = over 90%



DO YOU KNOW...


... how many of high-end smartphones contain „chips“ optimized by Integrated Circuit Material from us?





DO YOU
KNOW...

...to what extent are OLED
TVs more energy-efficient
than LCD?



DO YOU KNOW...

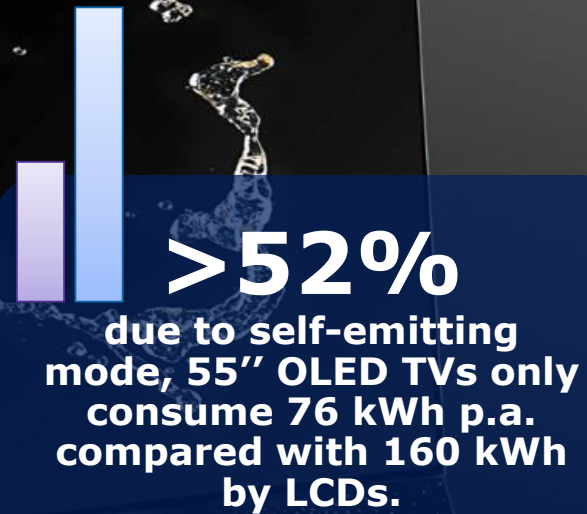
...to what extent are OLED
TVs more energy-efficient
than LCD?

A = 30%
B = 40%
C = 50%



DO YOU KNOW...

...to what extent are OLED
TVs more energy-efficient
than LCD?



CAN YOU IMAGINE...

...a smart liquid crystal
application in this
picture?



CAN YOU IMAGINE...

...a smart liquid crystal
application in this
picture?

A = Display
B = Window
C = Antenna



CAN YOU IMAGINE...

...a smart liquid crystal
application in this
picture?

**By replacing conventional
sun shading;
energy savings (up to 30%);
enabling new architecture,
facades and comfort**

**Smart liquid crystal windows based on LC
technology have huge potential for us**

WE ARE



We live in a world of possibility

A world where exploration and discovery are celebrated. Our research-driven businesses deliver diverse, high quality products that enrich lives and enable us to share business success with our customers.



**Family
Equity interest
70.3%**

Family-owned
for 12
generations



**Shareholders
Share capital
29.7%**

Publicly traded
since 1995
DAX member
since 2007



1668
founded



66
countries



~50,000
employees



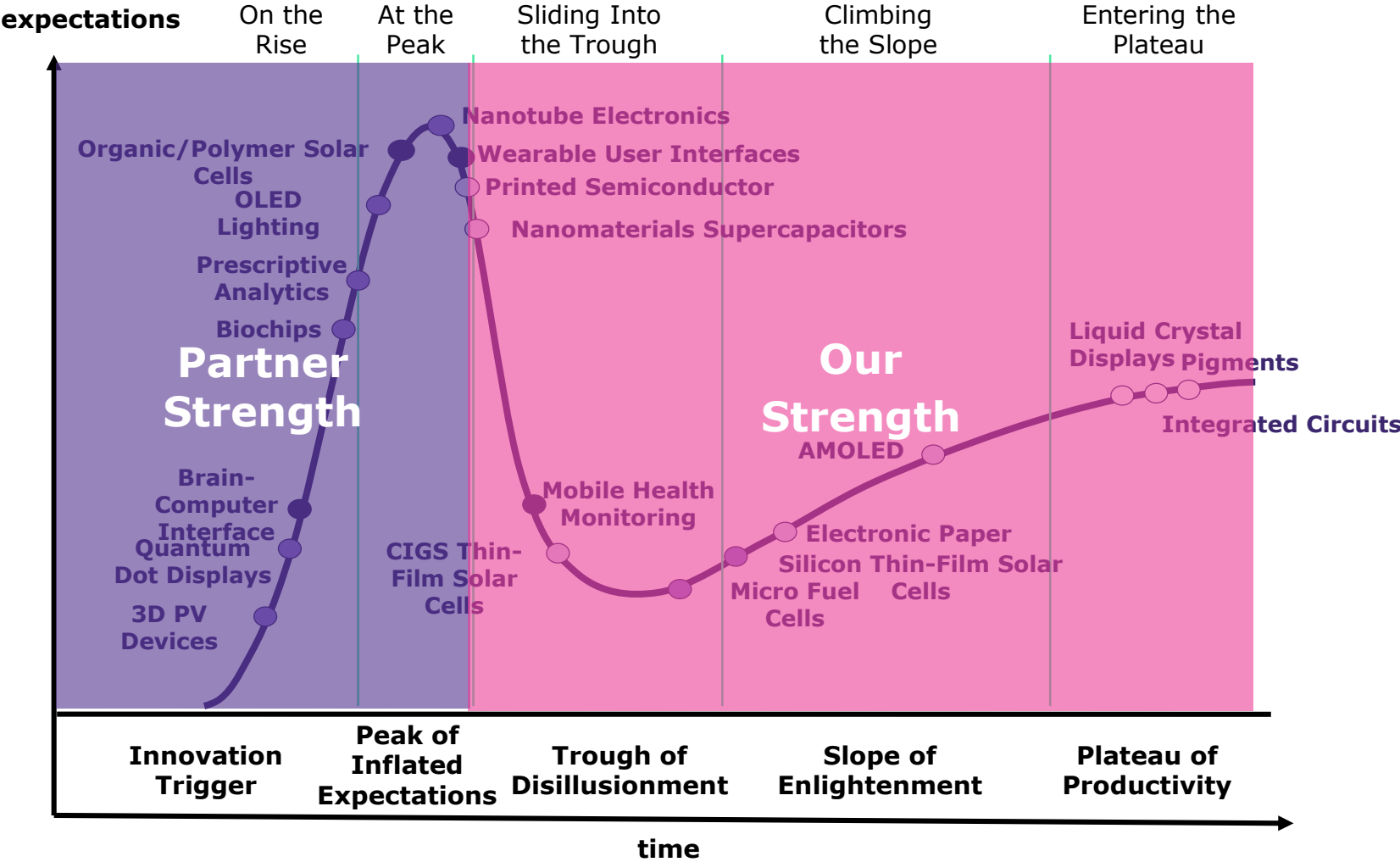
€1.7 bn
invested in R&D
in 2015



€12.8 bn
net sales in 2015

Gartner Hype Cycle

Our focus



Plateau will be reached in:

- < 2 years
- 2 - 5 years
- 5 - 10 years
- > 10 years

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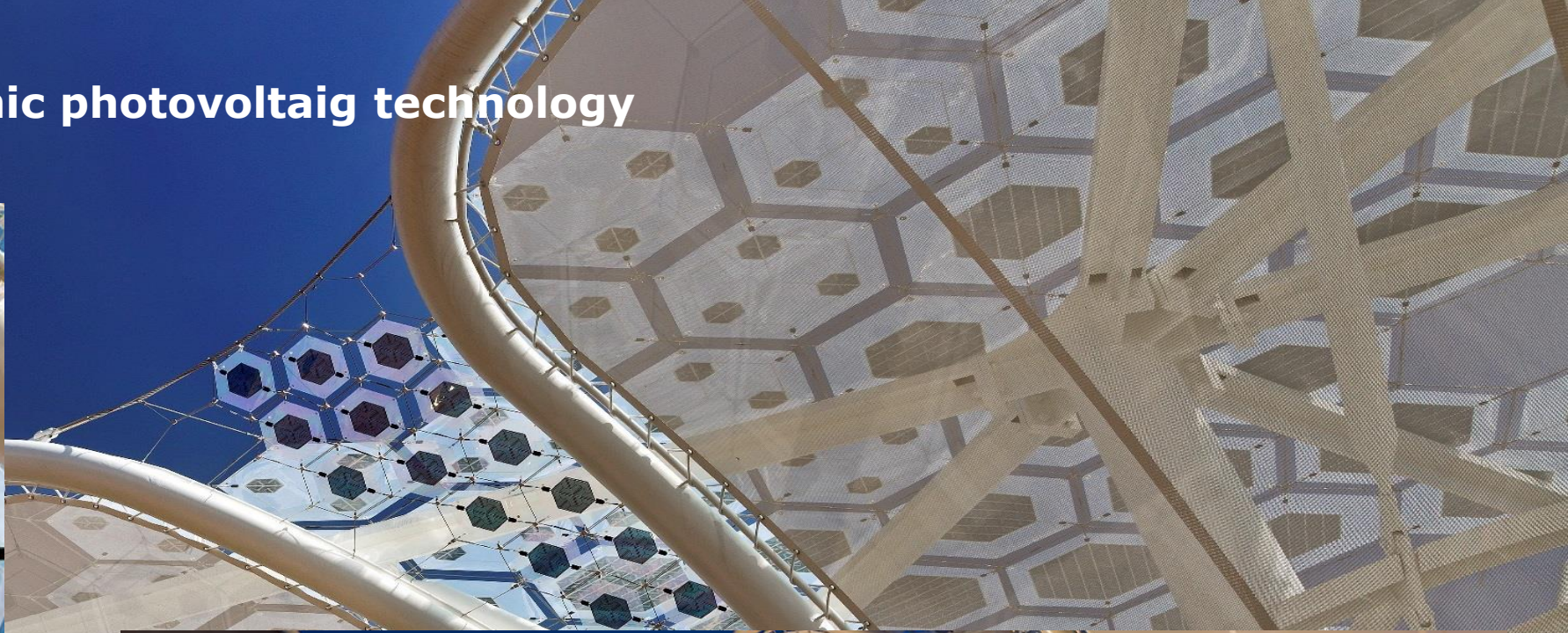
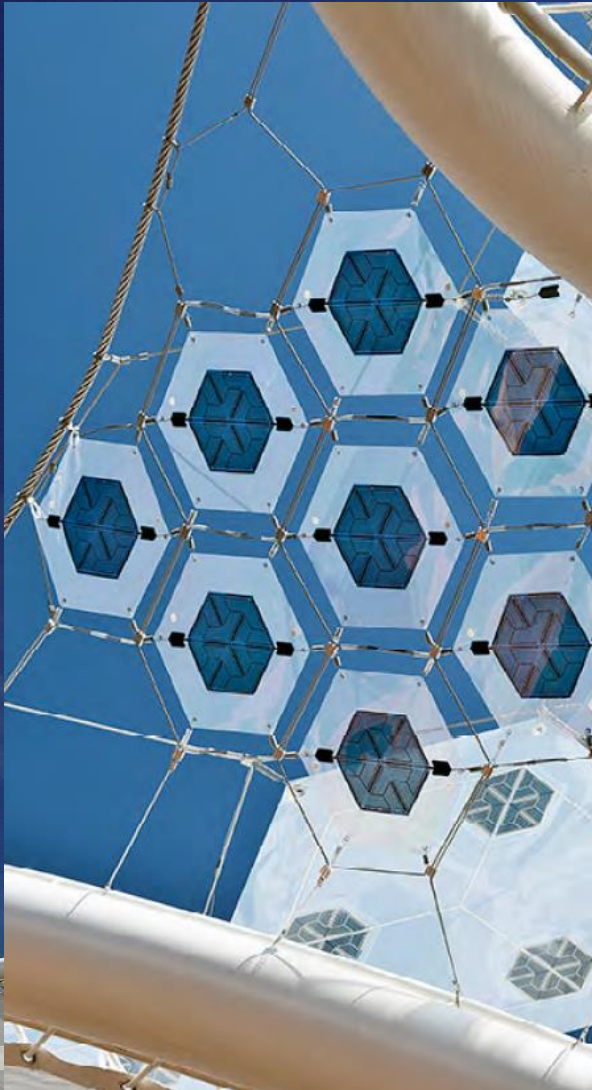
**What is
disruptive about
a living room?**





**What is
disruptive about
a tree?**

Solar trees with organic photovoltaic technology



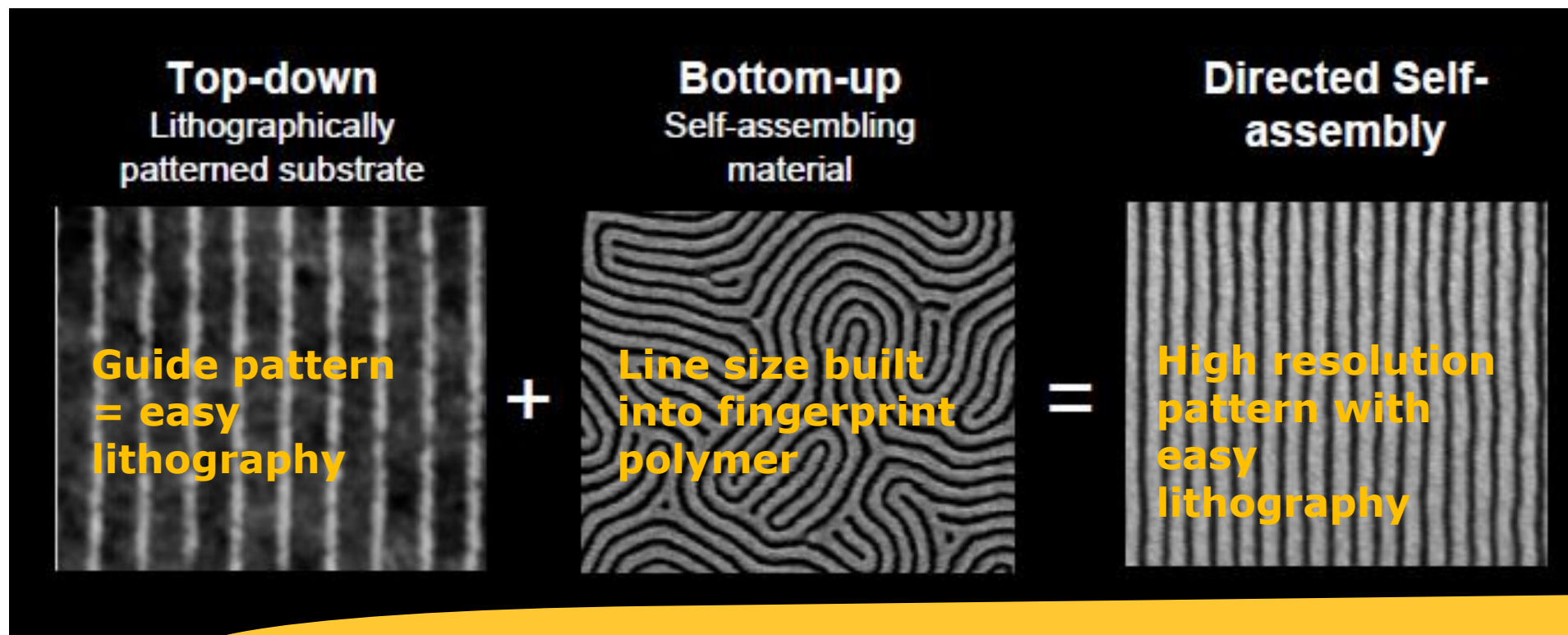


What is disruptive about a fingerprint?

Structures are smaller than what can be achieved with conventional lithographic methods of chip making.

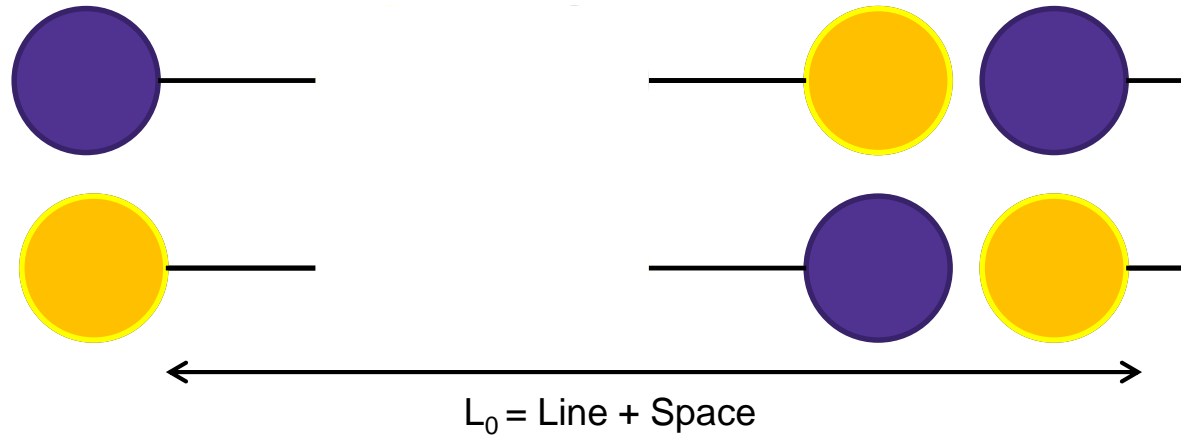
We are leader in the effort to use such polymers to fabricate next generation computer chips in a cost-effective way.

How can we make the Fingerprint Polymer Lithographically Useful?

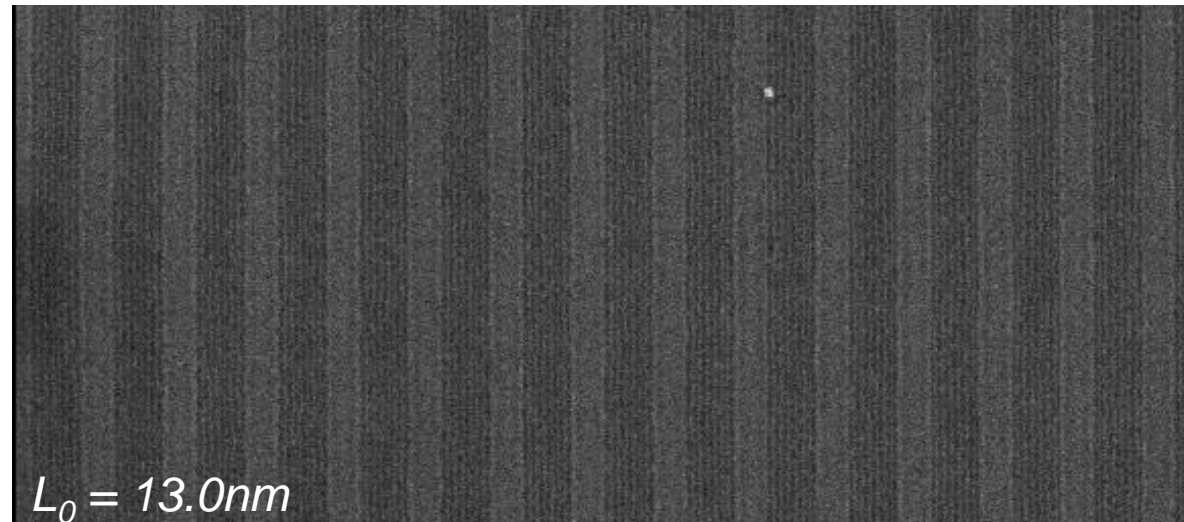
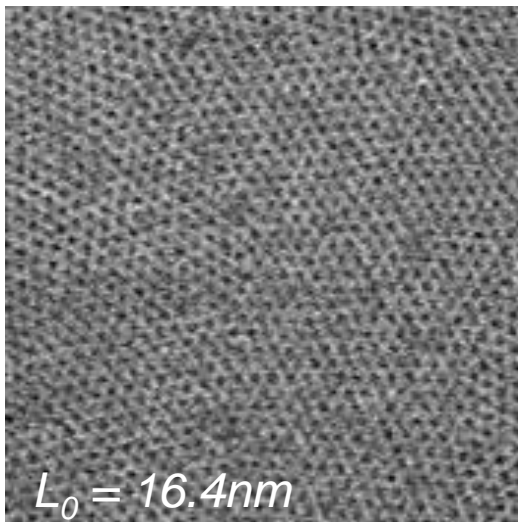


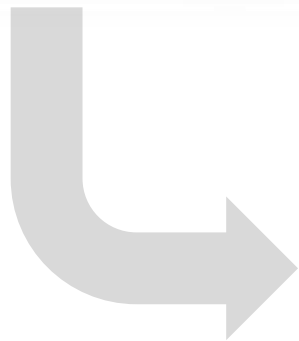
Directed Self-Assembly (DSA) is a paradigm shift in chip making: Only part of the information encoded in a chip layer comes from photolithography, the majority is already embedded in the DSA chemicals.

DSA Extendibility to Smaller Features (High Chi)



- 1st Gen DSA materials $L_0 \sim 20\text{nm}$
- We are leading in development on 2nd Gen DSA (High Chi)





Google™ glasses?

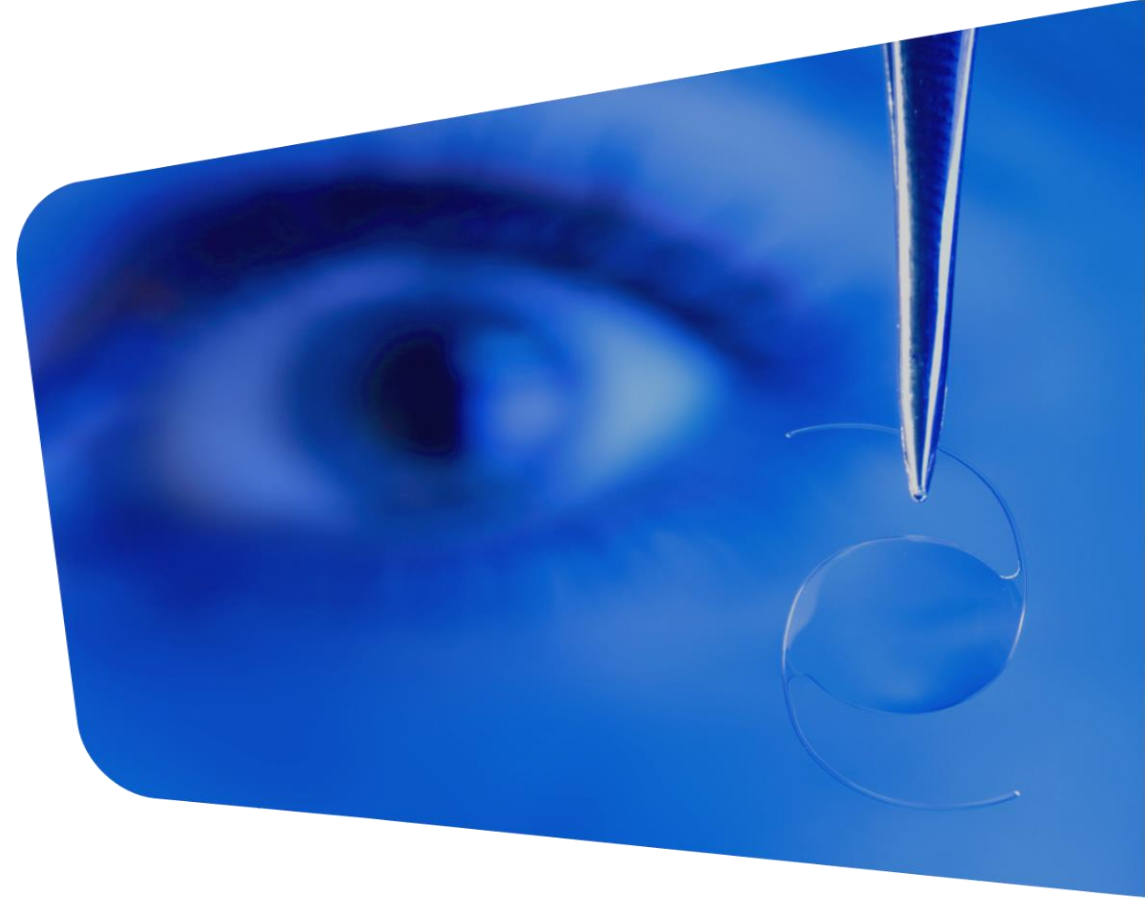
**What is
disruptive about
glasses?**

RE-Adjustable Lenses

RE-Adjustable **L**enses for restoring **vision** after cataract surgery through optically active materials. We have a **unique core competency** in non-invasively, continuously adjustable intraocular lens preforms.

Our concept offers:

- **Wide range** of reversible adjustment
- **Adjustment** achieved through a laser system
- Lens **unaffected** by normal light
- **Transparent**
- We target **perfect vision** for millions of patients worldwide





**What is
disruptive about
a bathroom?**



We are well-positioned to disrupt the future!



- **Prescription medicines** for cancer, multiple sclerosis and infertility
- **Over-the-counter products** for everyday health protection
- Innovations in the areas of **allergies and biosimilars**



- Innovative **tools** and **laboratory supplies**
- Products that make **research** and **biotech** production easier, faster and more successful



- **Liquid crystals and OLEDs** for displays
- **Effect pigments** for coatings and cosmetics
- **High-tech materials** for the electronics industry

