

**3M** Science.  
Applied to Life.™

3M SINGAPORE  
**50**<sup>th</sup>  
ANNIVERSARY

# Micro Fabrication Macro Application

3M's journey in transforming miniature science and engineering into products that changes life for the better

26<sup>th</sup> Feb 2016



## Our Vision

3M Technology Advancing Every Company

3M Products Enhancing Every Home

3M Innovation Improving Every Life



# We help customers succeed through five business groups



## **Consumer**

Making life easier and more productive at home and work



## **Health Care**

From preventing infections to making smiles brighter



## **Electronics & Energy**

Enabling tomorrow's lifestyle today by contributing to power, communications and electronics



## **Safety & Graphics**

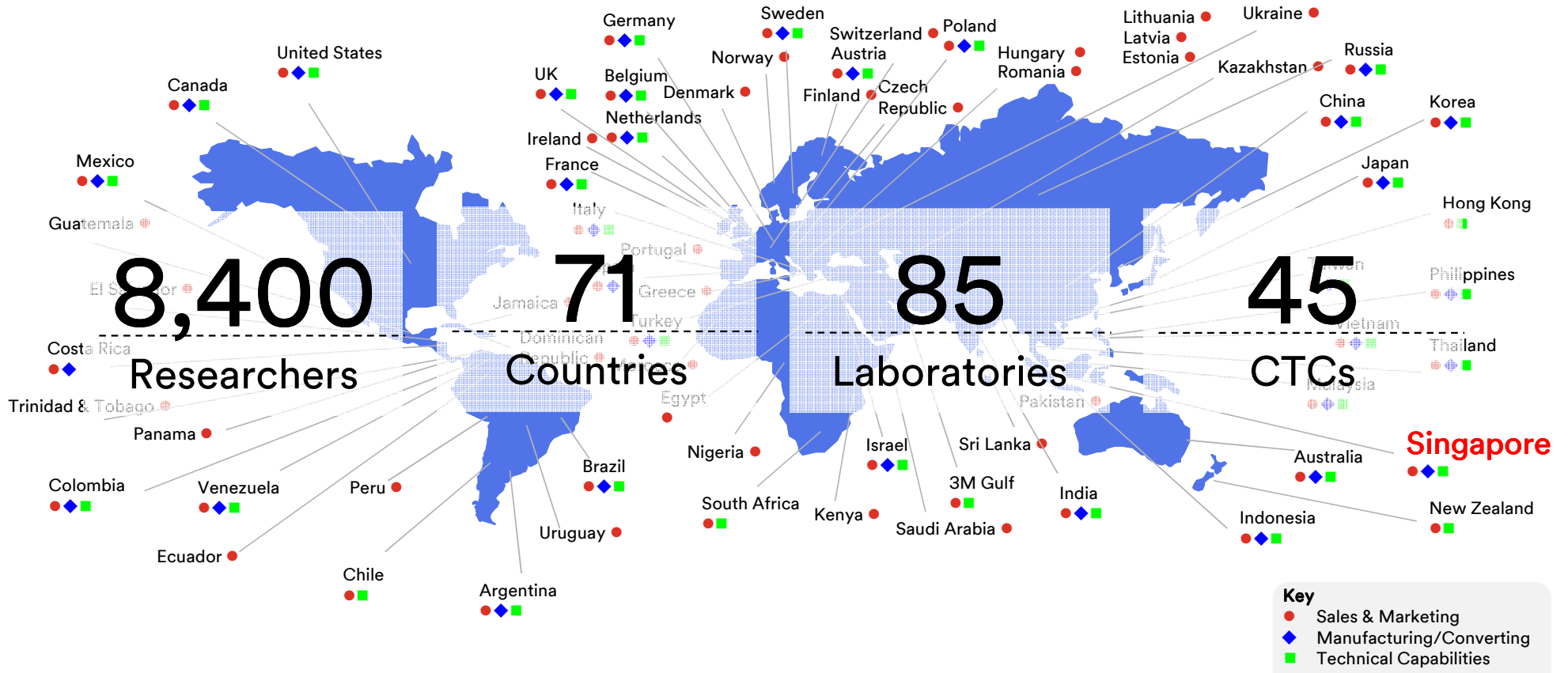
From protecting people and information to enhancing visual and design communication



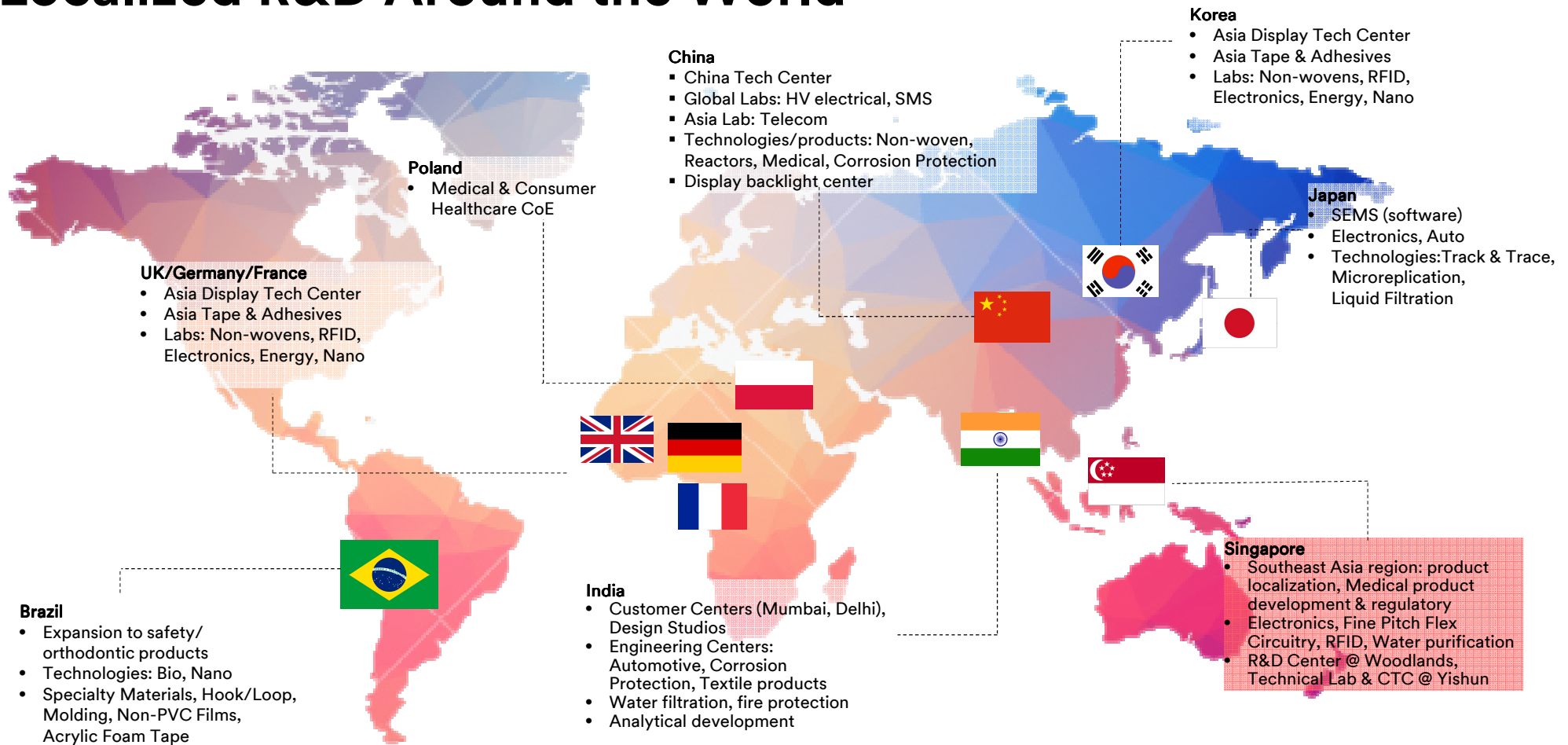
## **Industrial**

From purification to aerospace: changing how industry works

# Global Footprint to Serve Global Customers



# Localized R&D Around the World



# 50 Years of Improving Lives in Singapore

## Established Operations to Serve Local & Regional Customers

Year 1966  
Founding



Year 1998  
Woodlands



Year 1999  
R&D Centre



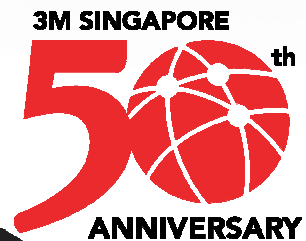
Year 2009  
Tuas



Year 2014  
Yishun CTC



Year 2016  
Golden  
Jubilee



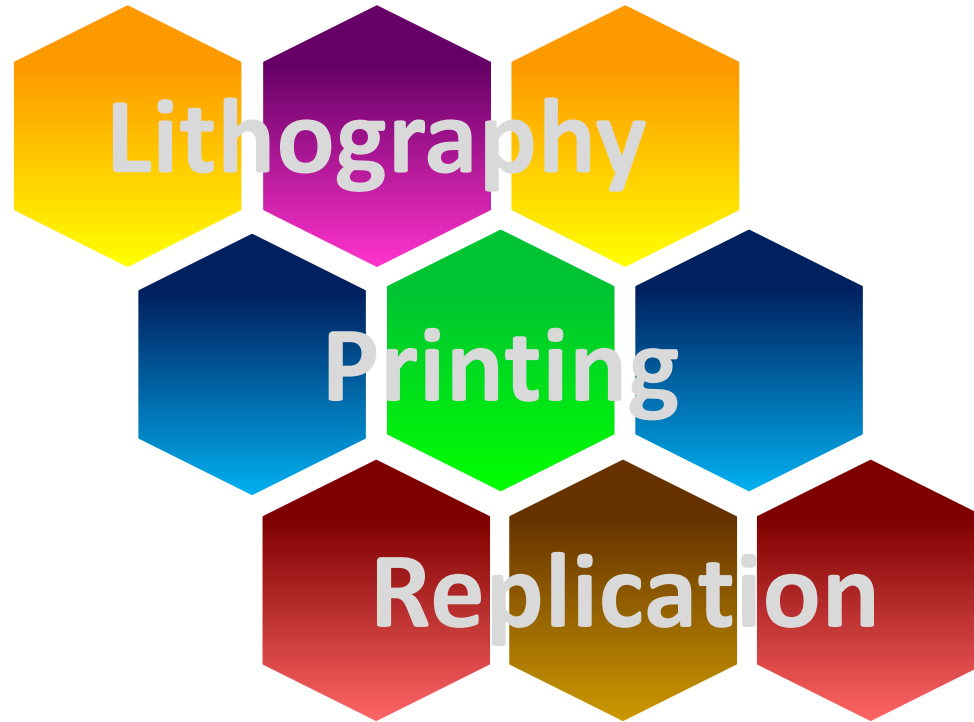
Gaining accolades along the way ...

- 5<sup>th</sup> Top Private Employer of Choice
- Community Spirit Merit Award
- PR Awards (Bronze) for Best CSR Communications
- Green Mark (Gold) Award
- Singapore Manufacturing Excellence Award (Operational Excellence)
- Singapore Quality Award

The image features a dark, textured background of microscopic particles, possibly microbeads or cells, with a bright green arrow graphic pointing to the right. The text is overlaid on the left side of the arrow.

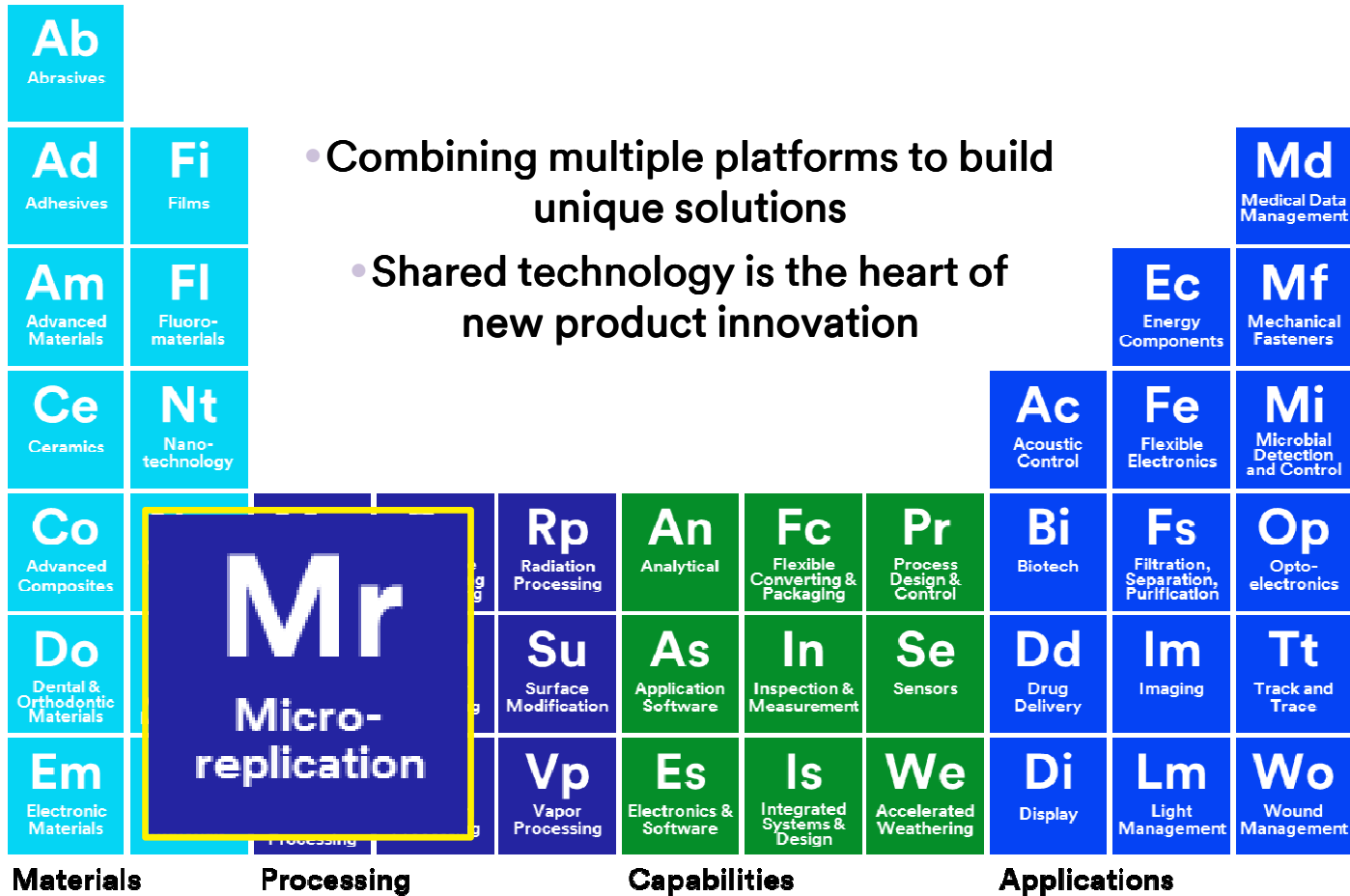
**Micro fabrication  
Advancing society**

# Technologies





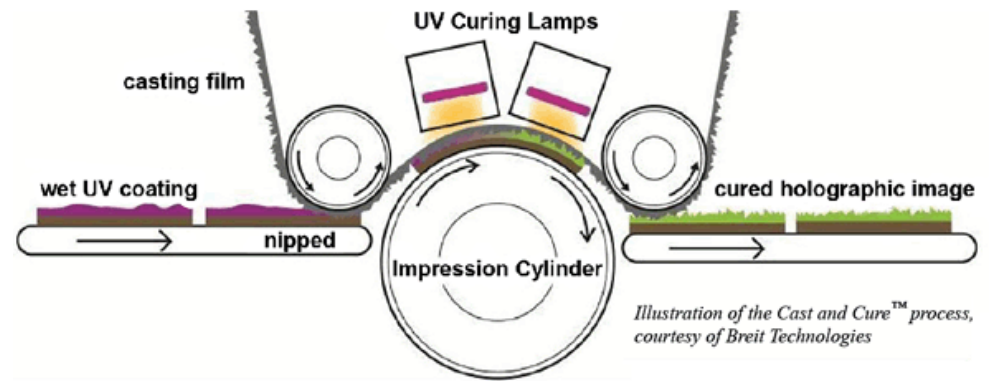
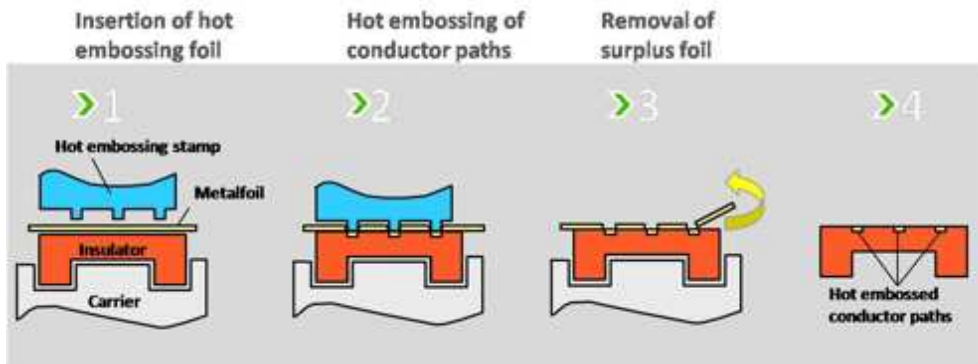
# 3M Science is the foundation for our 46 core technologies



- Combining multiple platforms to build unique solutions
- Shared technology is the heart of new product innovation



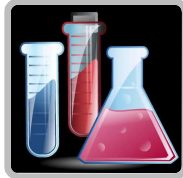
# Microreplication Processing Technology



Hot Embossing  
or  
Microthermoforming

Cast & Cure

# Other Technology-influencing Knobs



## Formulations

Affecting processing conditions; Achieving desired properties



## Process Conditions

Hot or cold processes; Batch or continuous processes



## Product Configuration

Flexible or rigid? Transparent or opaque? Aspect Ratio? Application?



## Hardware

Capital cost; Equipment configuration;



## Cost Efficiency

Cost of producing versus Market size / acceptance

The image features a wide-angle shot of the Great Pyramids of Giza in Egypt, set against a clear blue sky. The pyramids are constructed from large, weathered stone blocks. In the foreground, the sandy desert floor is visible, with a few small figures of people and camels in the distance. A large, bright green geometric shape, resembling a stylized arrow or a large 'V', is overlaid on the right side of the image, pointing towards the pyramids. The text is centered over the image, with the first line 'Macro applications' positioned above the second line 'Enhancing your home', and the third line 'Improving your life' positioned below the second line.

**Macro applications**  
**Enhancing your home**  
**Improving your life**



1960s

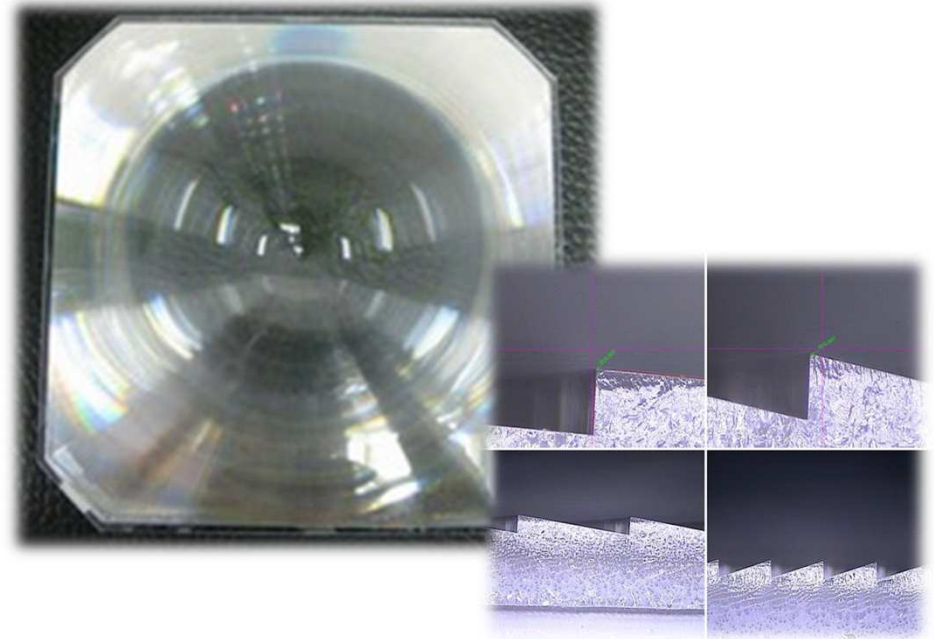
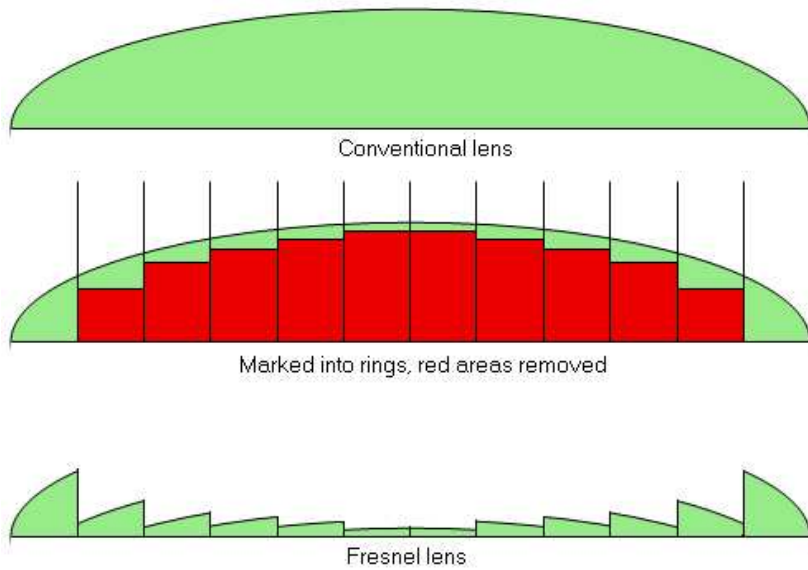




# Microreplicated Lens. Applied to displaying for a large audience

3M™ overhead projectors have flat Fresnel lens that enables users to enlarge their materials for display to a large audience.  
With 3M around, your life is made easier.

# Microreplicating a Fresnel lens





**STAR  
WARS**

**1970s**

**Short Facts**  
On Singapore First Cable

- 3,800 metres  
haul rope length
- 1,750 metres  
length of the cableway
- 700 passengers
- 8.5 minutes  
trip from Marina Bay to Sentosa
- 3.5 metres per second  
average speed



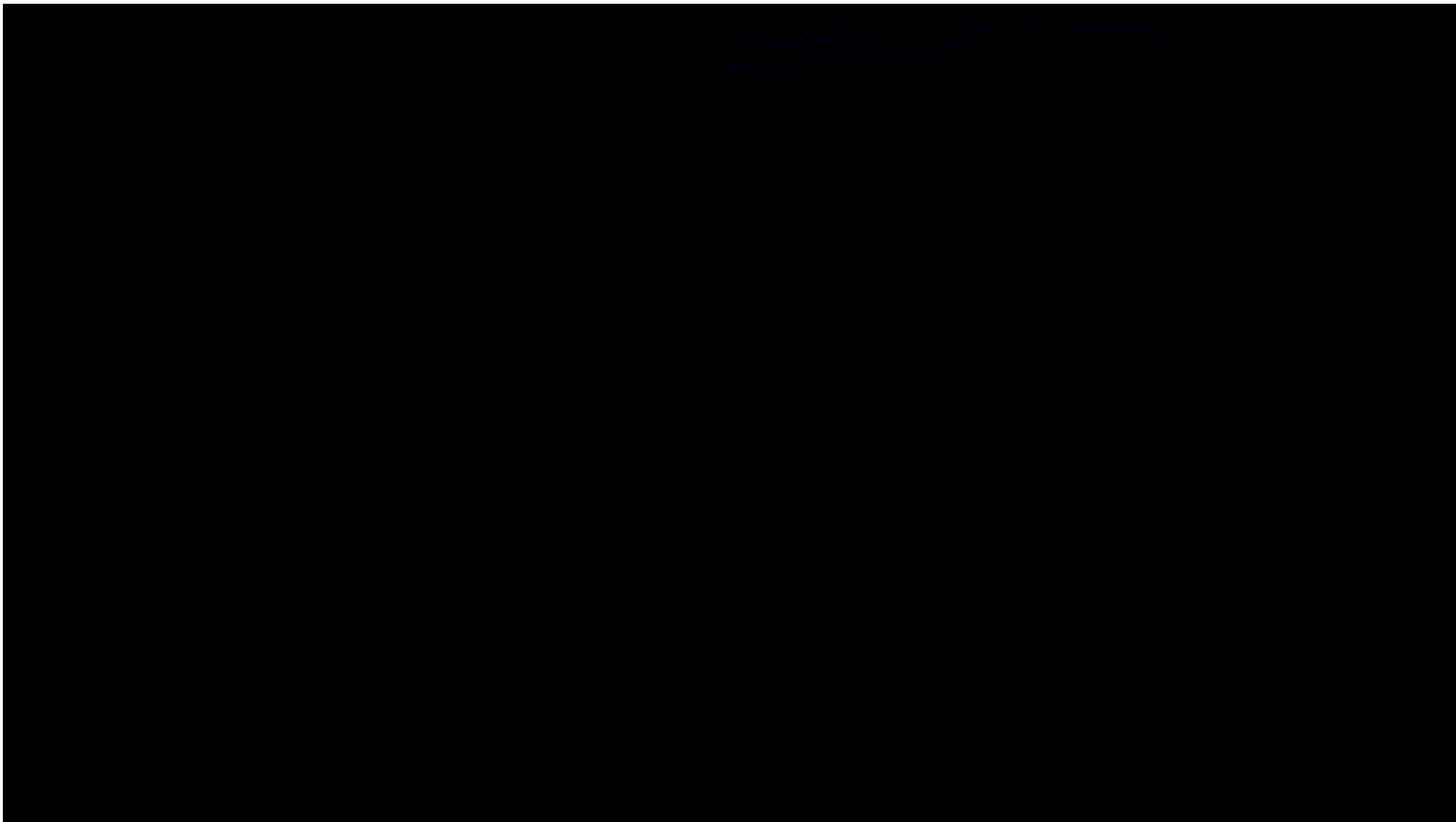


EXIT 10B

Marine Parade  
East Coast  
Park

**Microreplication.  
Applied to making driving at night  
safer for you.**

Microreplication was first introduced in 1970s to create better, brighter road signs. These new signs can reflect light back to the source, so that drivers can see the road signs better.





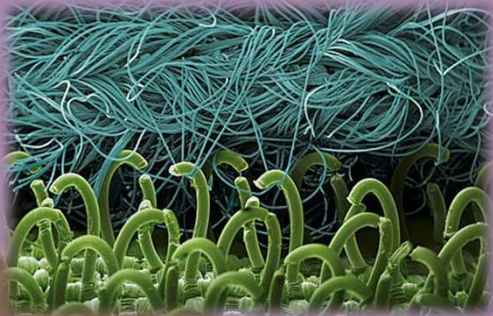
1980s



**Microreplicated hooks:  
Applied to fastening your child's  
diaper for better comfort.**

3M's Mechanical Closure Systems are designed to meet the needs for soft, flexible and high performance closure systems of open style baby diapers and adult incontinence briefs.







1990s

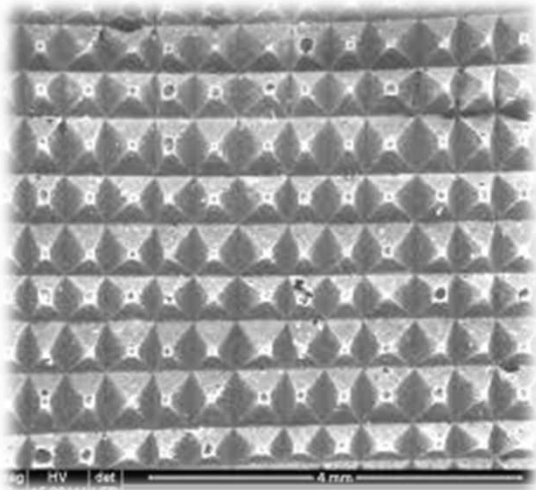
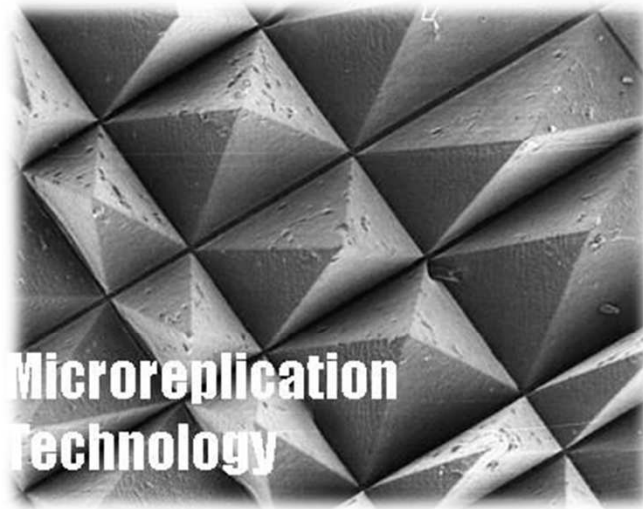
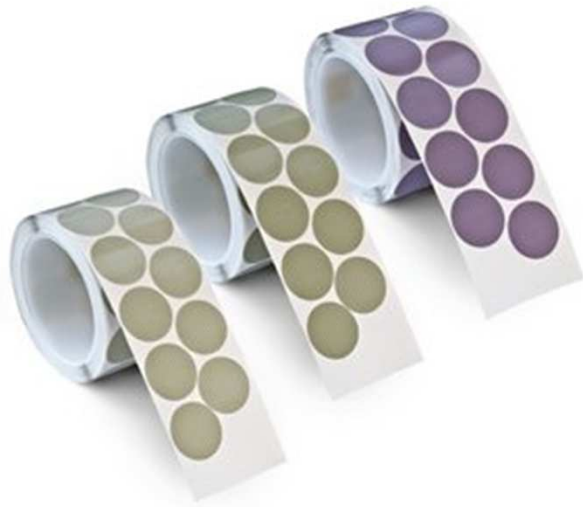


**Microreplicated Grains.  
Applied to shining your golf clubs.**

**3M™ Trizact™ abrasives have precisely arranged shaped structures which gives your golf clubs a more predictable, consistent finish.**

**With 3M around, your life is made easier.**

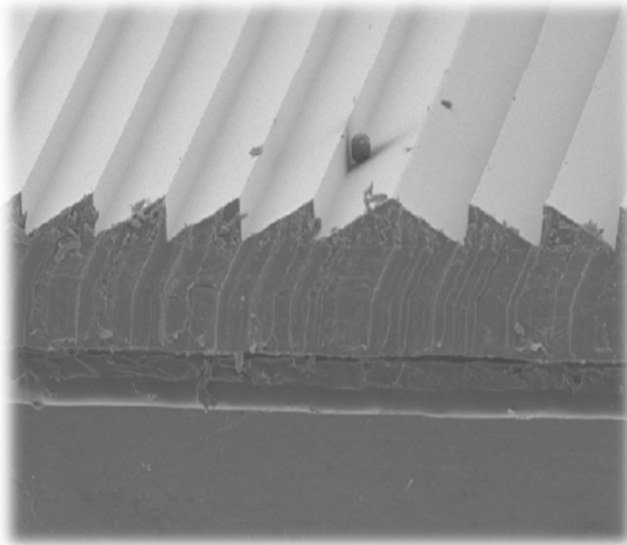
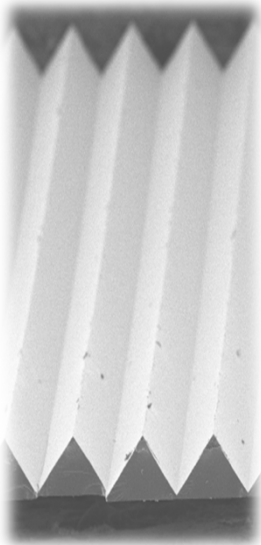
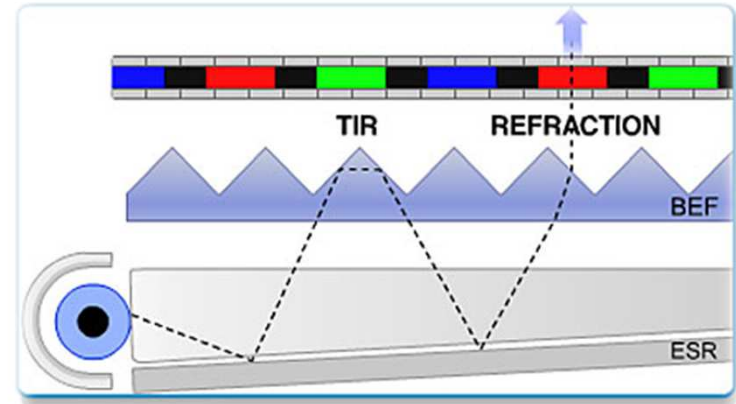
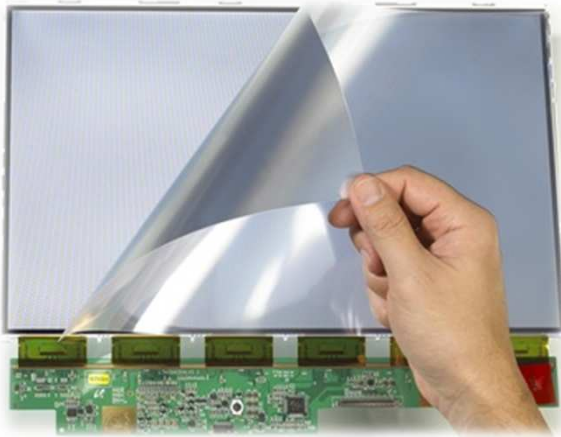




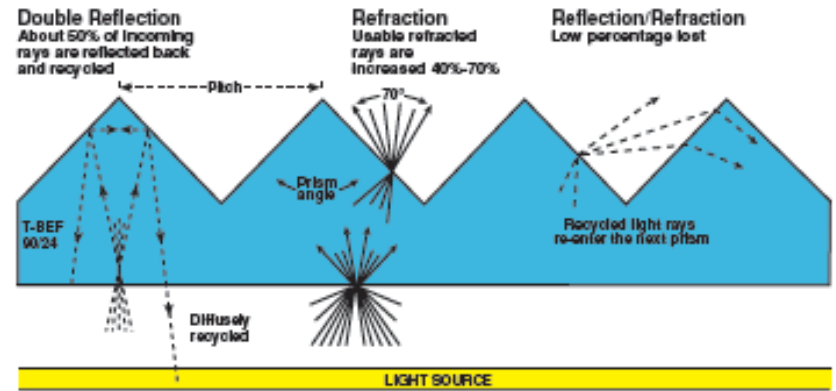


## **Microreplicated films. Applied to reducing your electrical bill.**

**3M™ Vikuiti™ brightness enhancement films have micro-replicated prismatic structures to provide brightness gain. Vikuiti recycles diffuse light into the backlight and directs the light through the LCD, thereby providing increased brightness toward the viewer. This increased brightness is translated into power savings.**



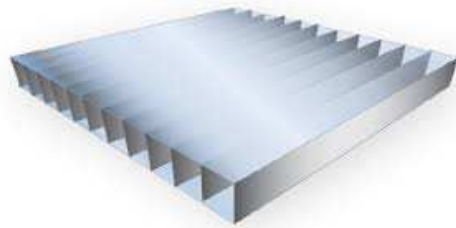
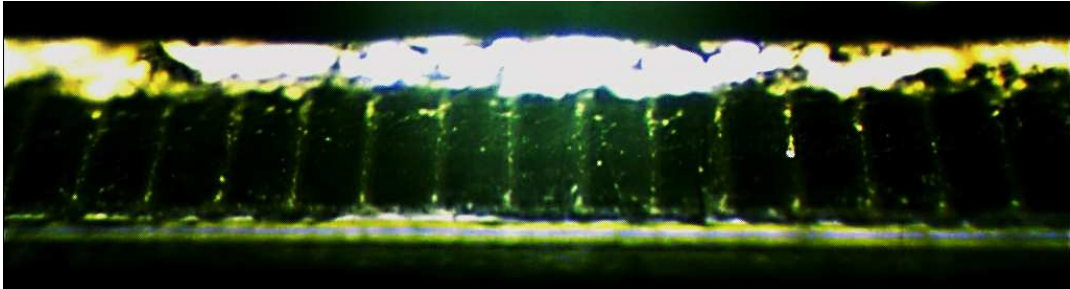
### Vikulti™ BEF II Operation



A photograph of an airplane cabin interior. A person is seated at a table with a laptop and a glass of amber liquid. A large, bright magenta triangle is superimposed over the left side of the image, containing white text. The background shows other passengers and airplane seats.

## **Microreplicated films. Applied to protecting your information.**

**Keep visual hackers in the dark with 3M™ Privacy Filters.  
Remarkable, advanced technology “blacks out” side views of  
your screen while allowing you to see your screen clearly.**



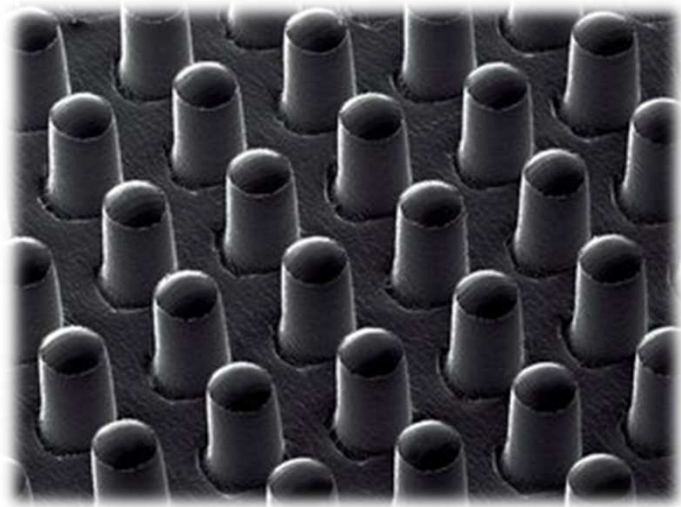


2000s



**Microreplicated surfaces.  
Applied to providing a good grip  
for optimum performance.**

Greptile™ microreplication technology gives golfers a tighter grip with less effort. Using thousands of microreplicated fingers, the glove creates optimal gripping friction to reduce slip and increase swing control.



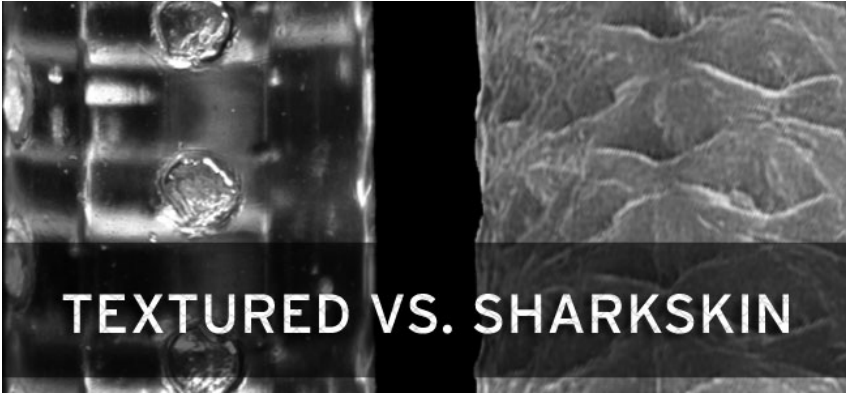




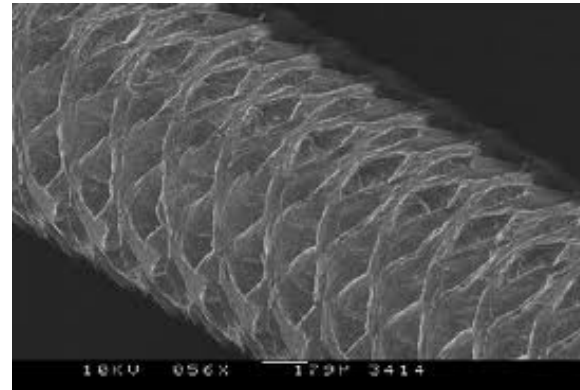
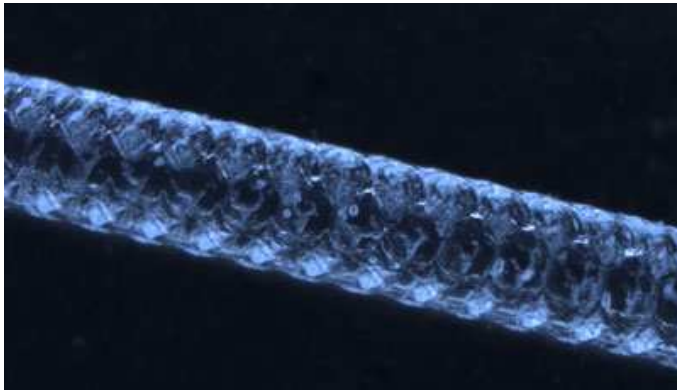
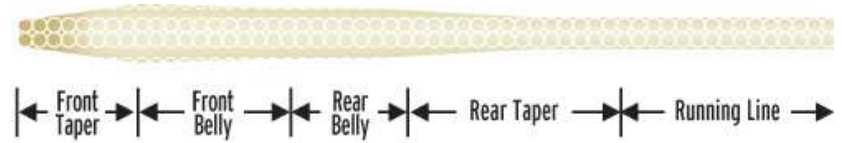
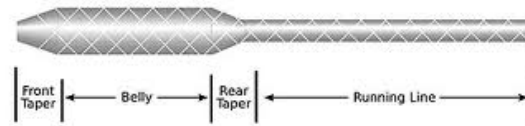
## **Microreplicated Strings. Applied to assisting the fly fisher.**


Featuring 3M's proprietary microreplication technology, Sharkskin is a radical modification of typically smooth-surfaced fly lines. Its micro textured surface traps air to provide superior shootability and floatation while eliminating line flash and vastly reducing friction.

All of this comes with the added benefit of increased durability allowing the line to last up to twice as long. Because of the increased surface area, this line sits higher in the water offering less drag, easier mending, roll casting, and pick-ups and less water spray.



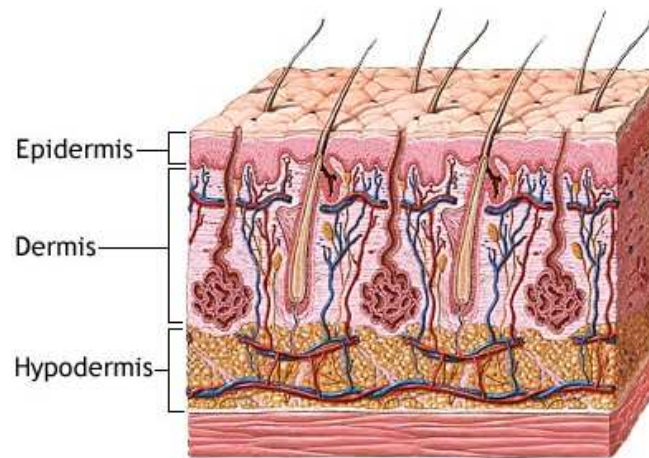
### Sharkskin GPX Taper





**Microreplicated needles.  
Applied to making doctor visits  
painless for you.**

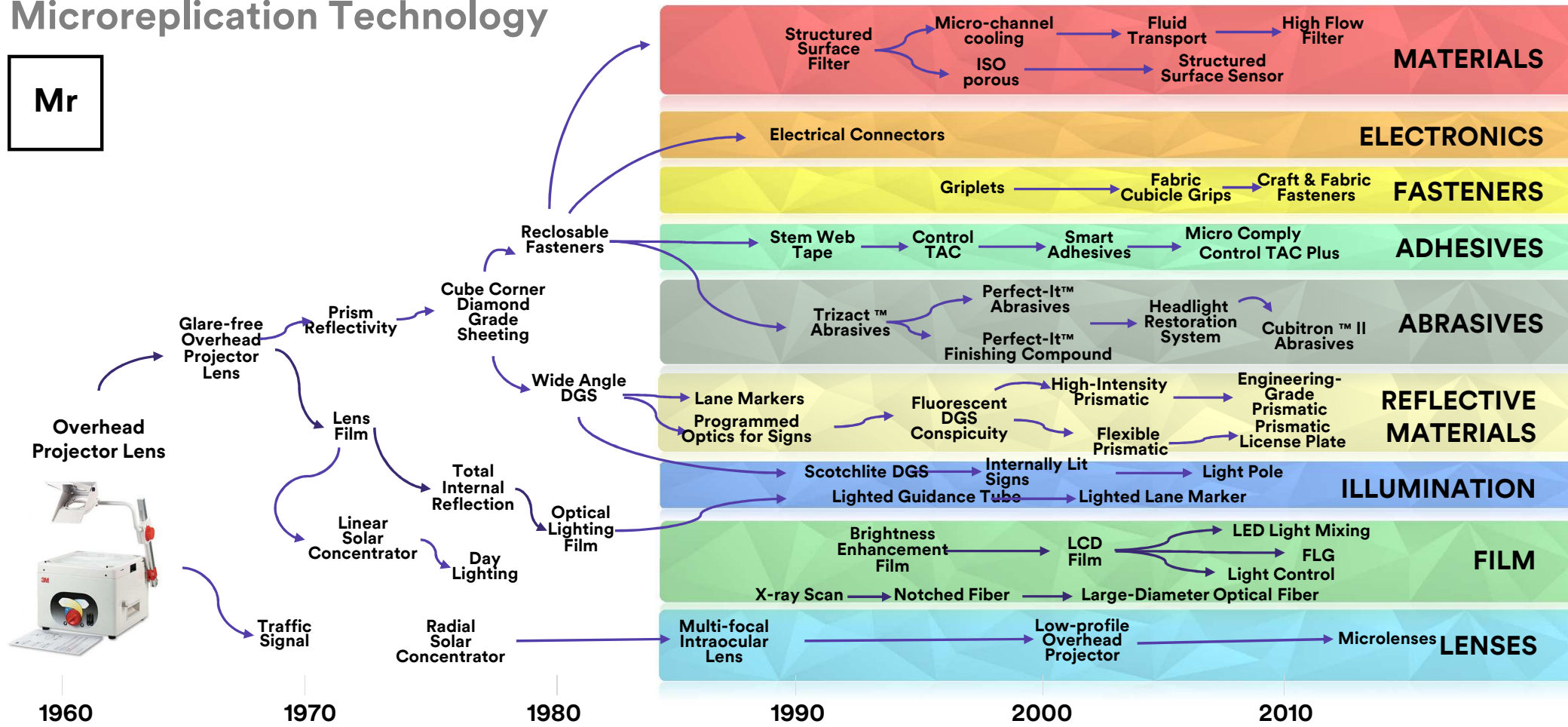
3M uses this technology to make tiny plastic disposable patches in the 3M™ Microchannel Skin System, allowing dermatologists to create tiny holes in your skin. 3M innovates to make sure you have no pain.



# Product and Technology Migration

## Microreplication Technology

Mr





## Our Vision

3M Technology Advancing Every Company

3M Products Enhancing Every Home

3M Innovation Improving Every Life



**Thank you**