

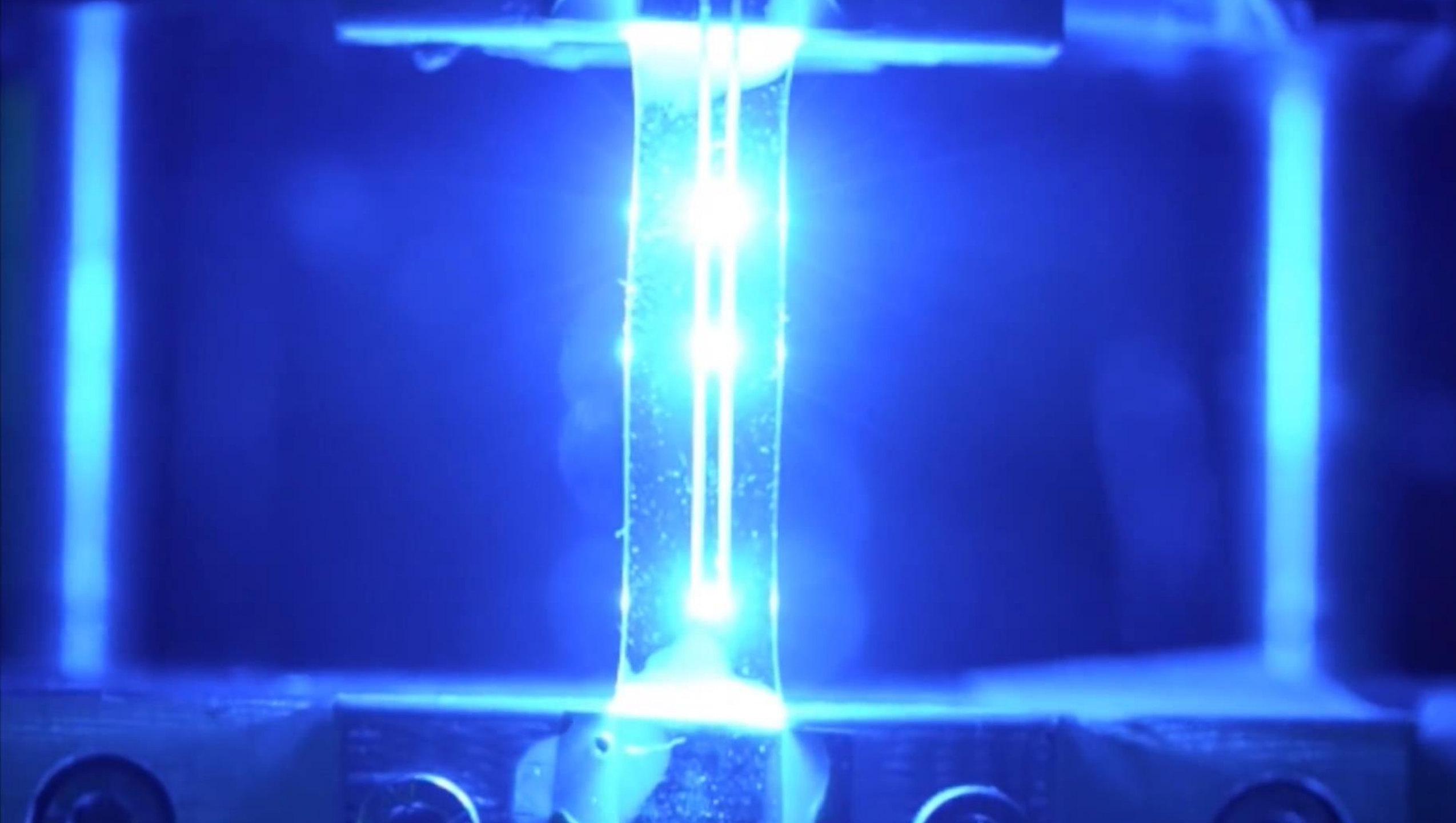
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Pathways to fully integrated stretchable electronics

Steven Nagels

FME summer school 14 sept 2017



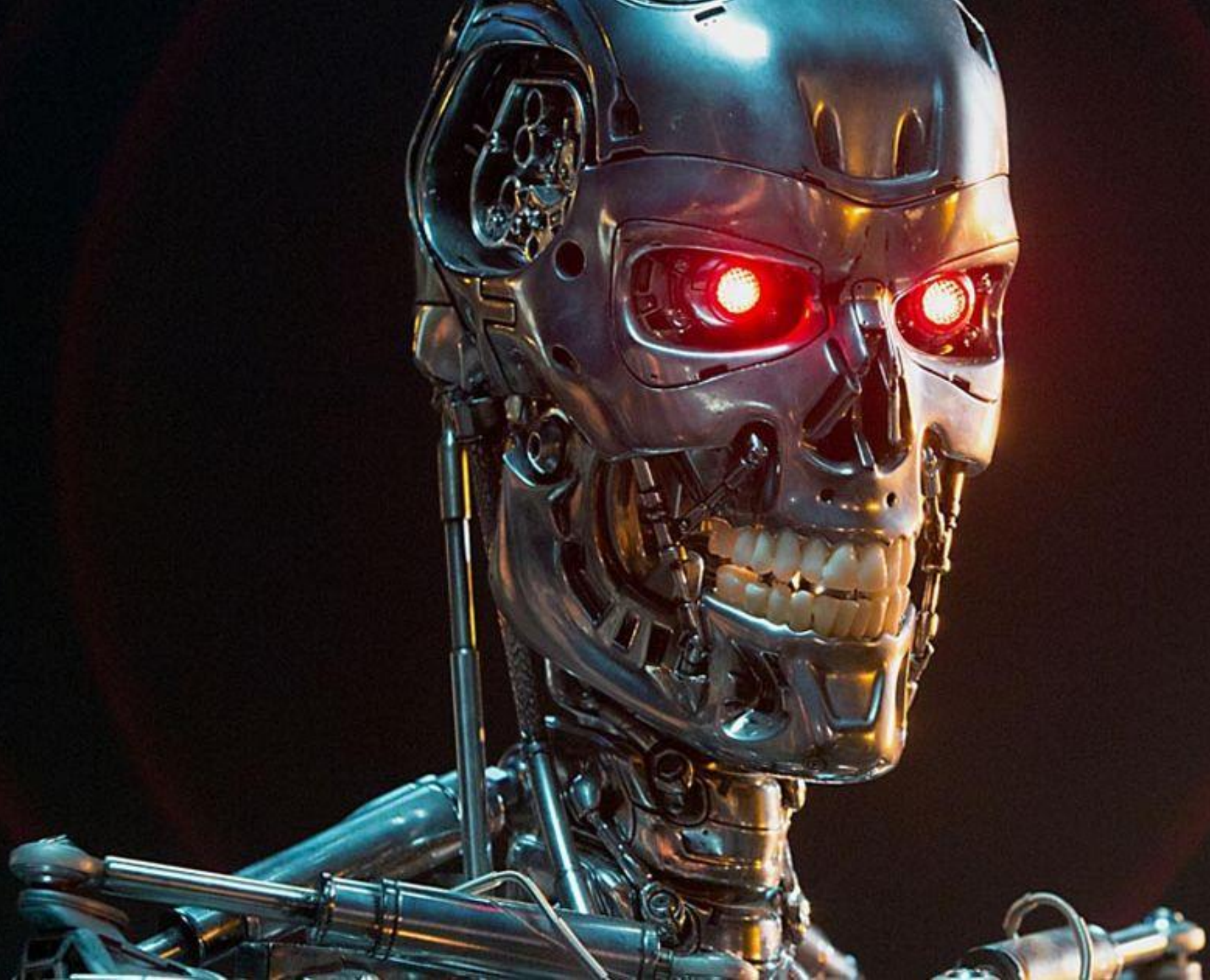


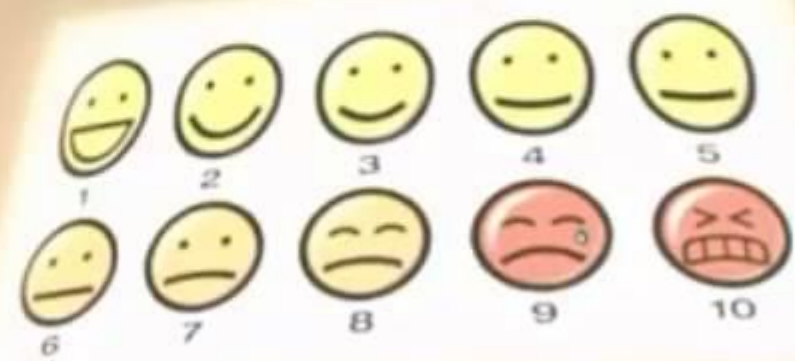
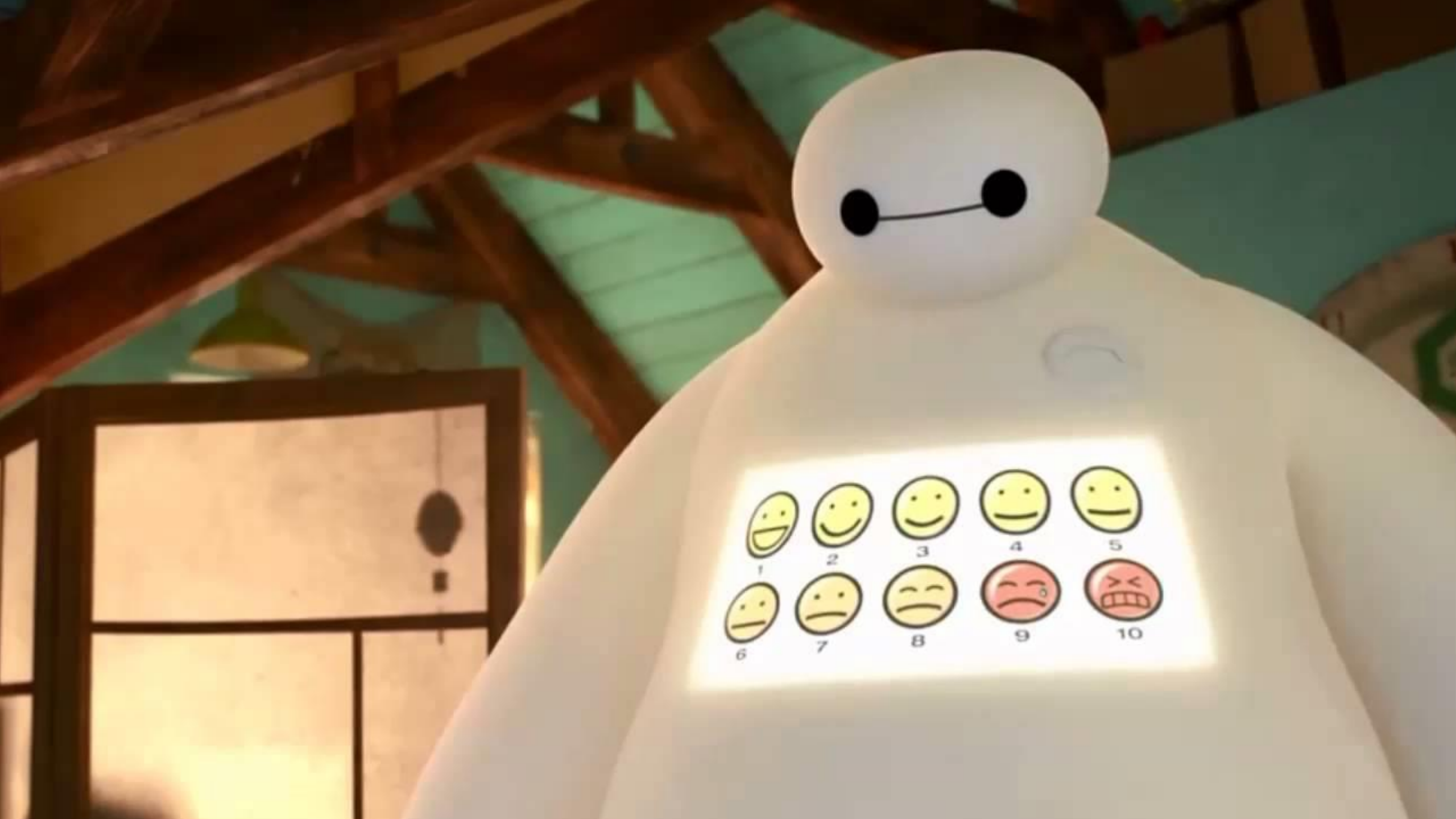
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Why do stretchable electronics matter?









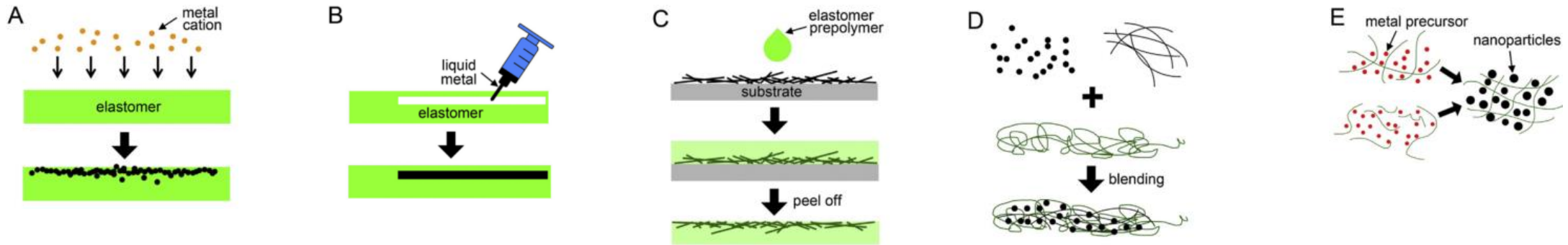


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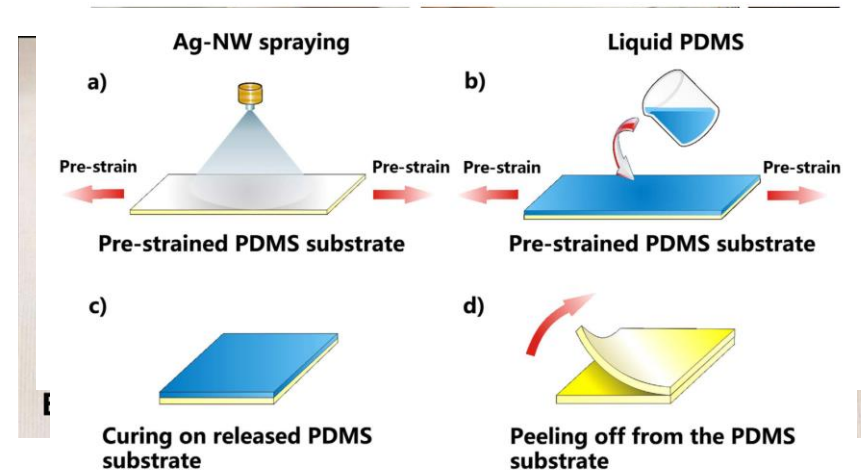
Approaches to obtain stretching conductors



Create intrinsically stretchable conductors

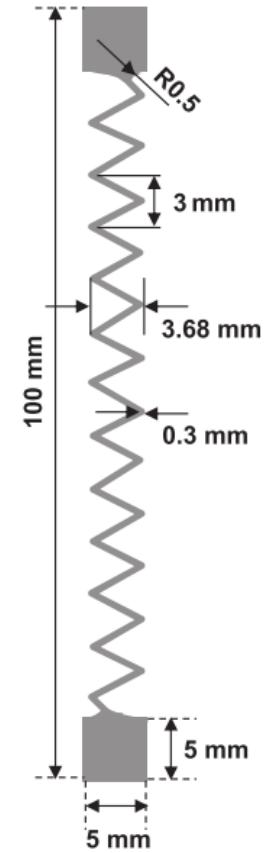
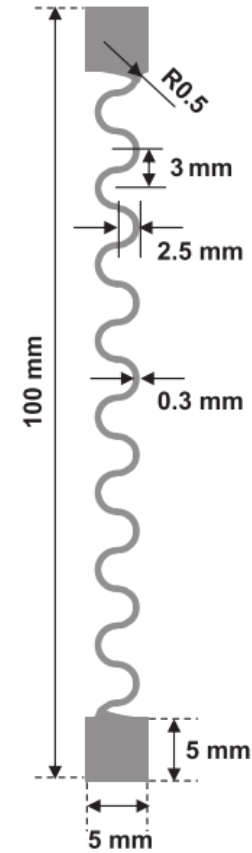
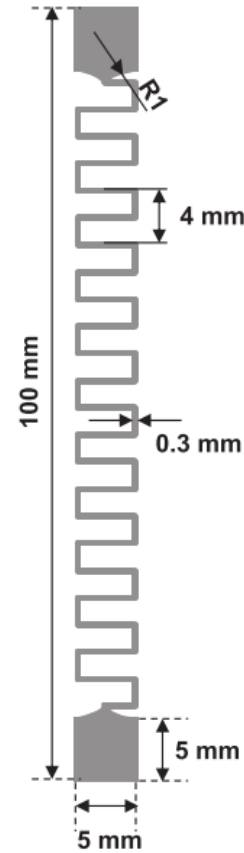
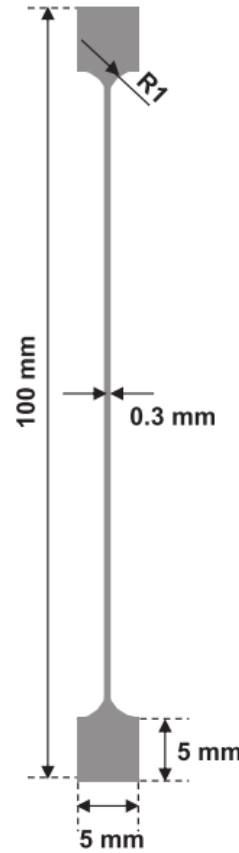
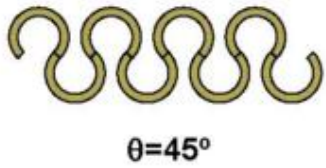
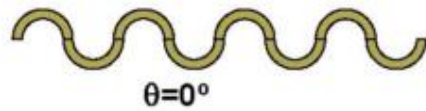
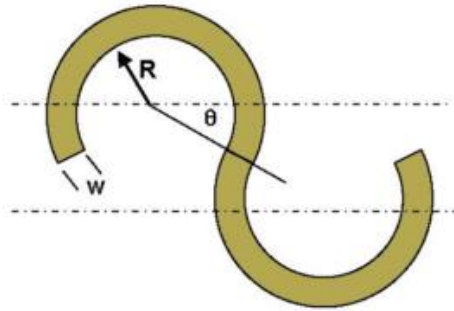


- A. Implanting conductive fillers in elastomers
- B. Filling microchannels with liquid metals
- C. Infiltrating elastomers with conductive-filler networks
- D. Blending conductive fillers with elastic polymers
- E. Synthesizing metal fillers within elastomers

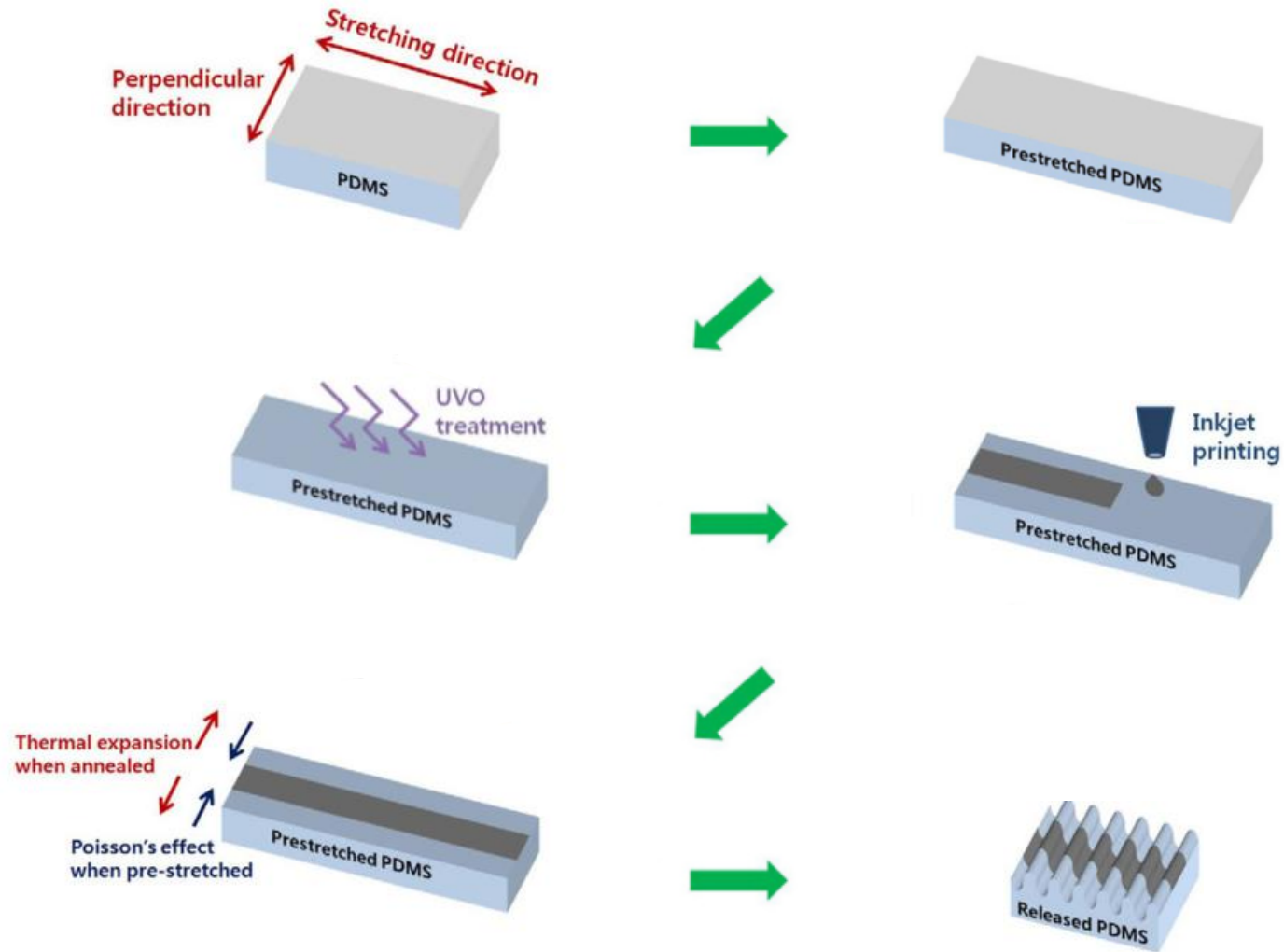


(Larmagnac, Leggenberger, Janossy, & Voros, 2014)
(Huang, Xiao, & Yu, 2015)

Geometries to handle strain



Geometries to handle strain

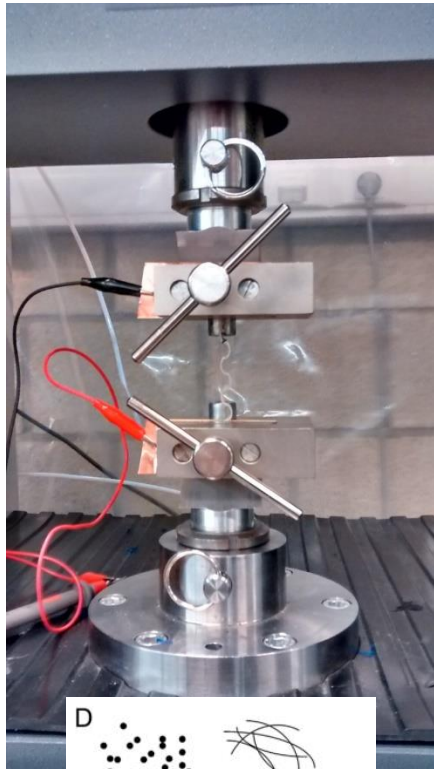


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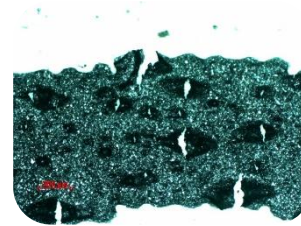
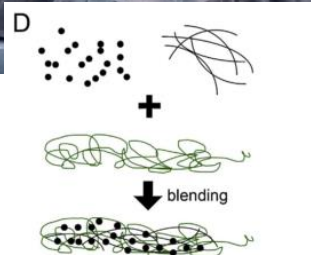
Studies @ UHasselt



Enhancement of screen paste stretchability



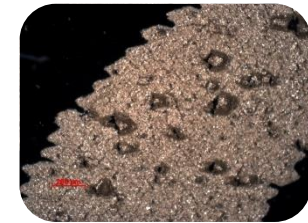
- Commercial conductive paste
- Blend in elastomer



25wt% acr



35wt% acr



45wt% acr

5wt%

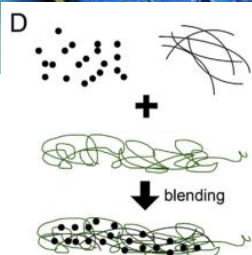
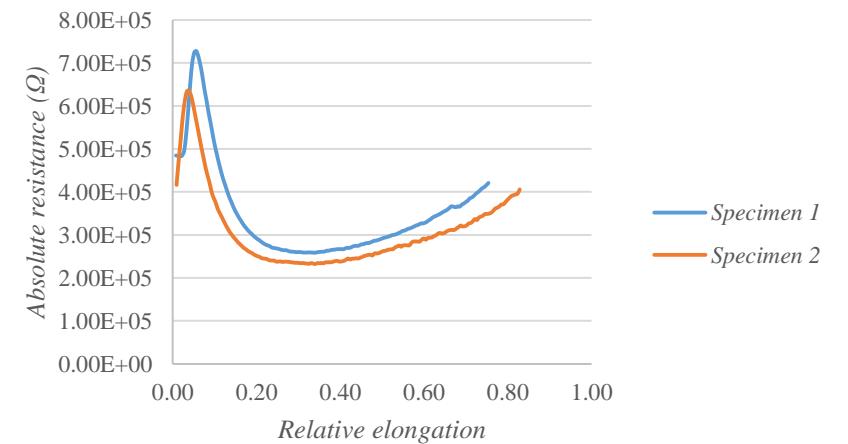
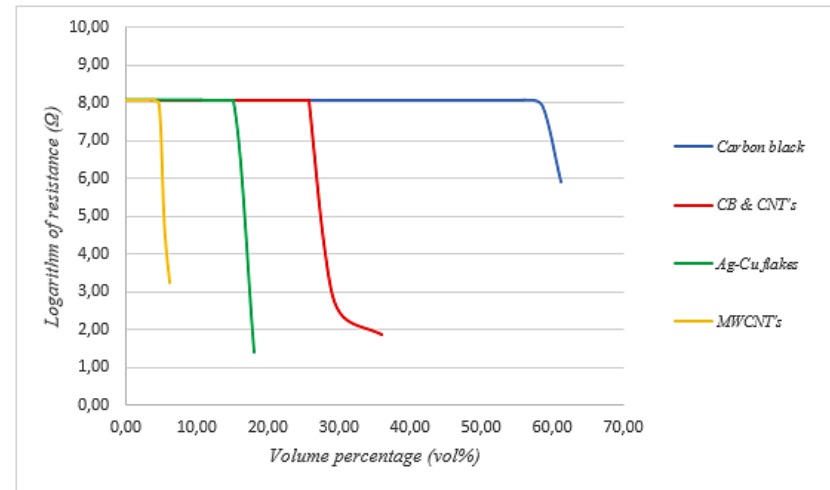
20wt%



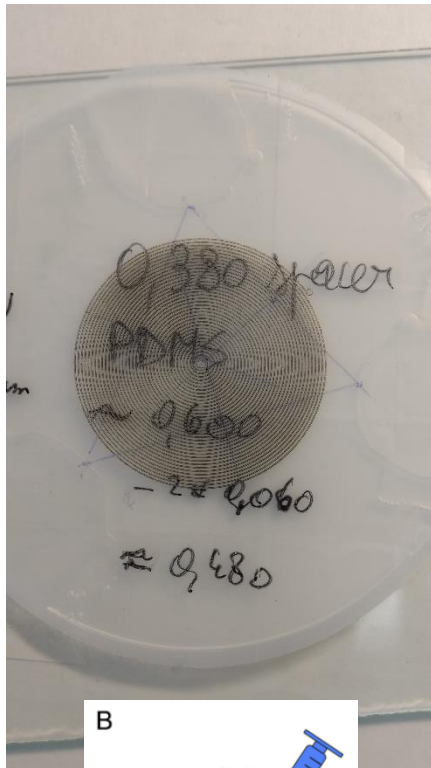
Percolation threshold of conductive blends



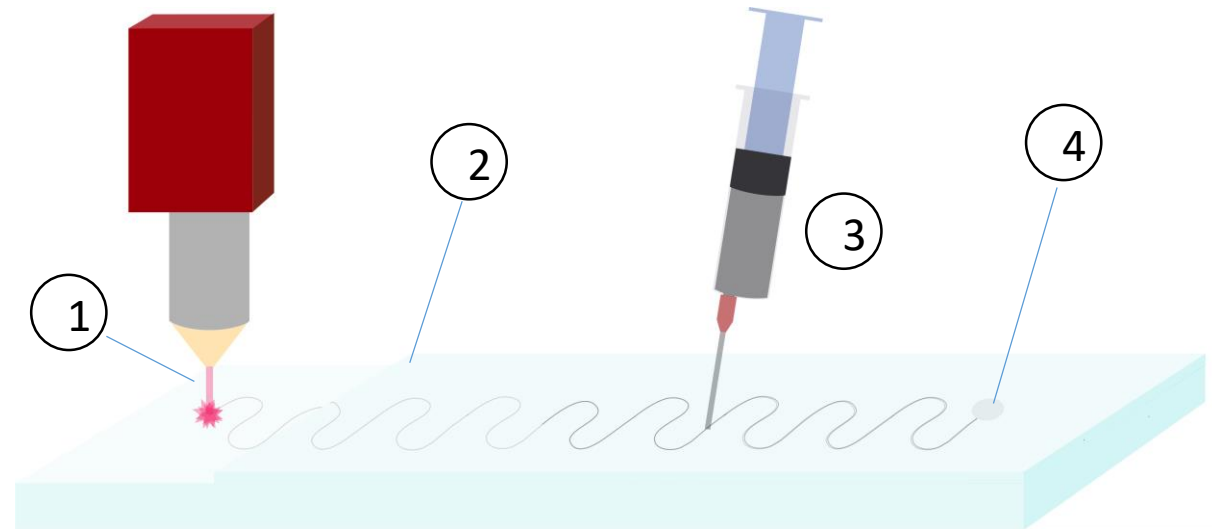
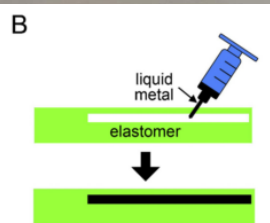
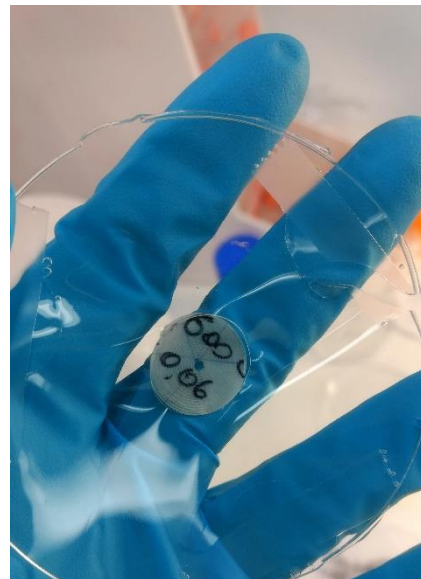
- PDMS elastomer
- Blend in conductive particles



2.5D laser engraving of conductive paths



- Laser engrave microchannels
- Fill with Galinstan



1 Laser engrave
2 Enclose channels

3 Fill with RT liquid conductor
4 Encapsulate liquid

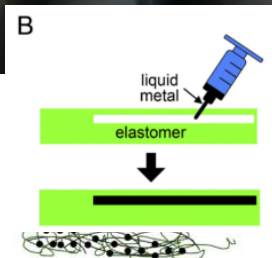
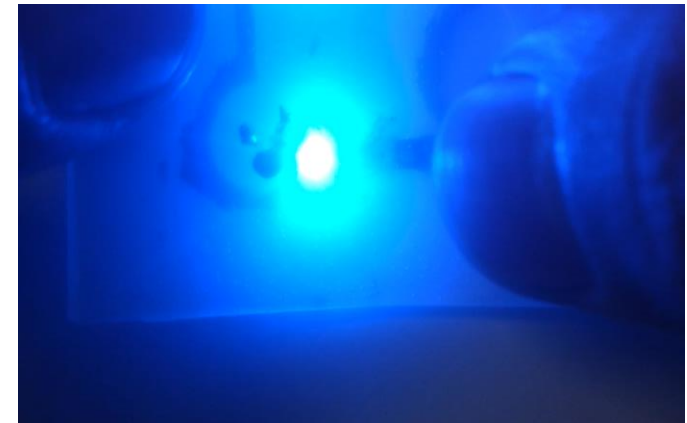


Fully integrated stretchable electronics



- Stencil printing of Galinstan
- Integrate components in a single process

- Fully integrated devices
 - Stretchable
 - Encapsulated
 - Self-healing



Fully integrated stretchable electronics

- Mainly based on usage of a laser cutter
- Main contribution
 - ➔ Makerspace compatible



