

# *TUNNEL OF LIGHTS*

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*by* Rosana Liang

*TECHNOLOGY*

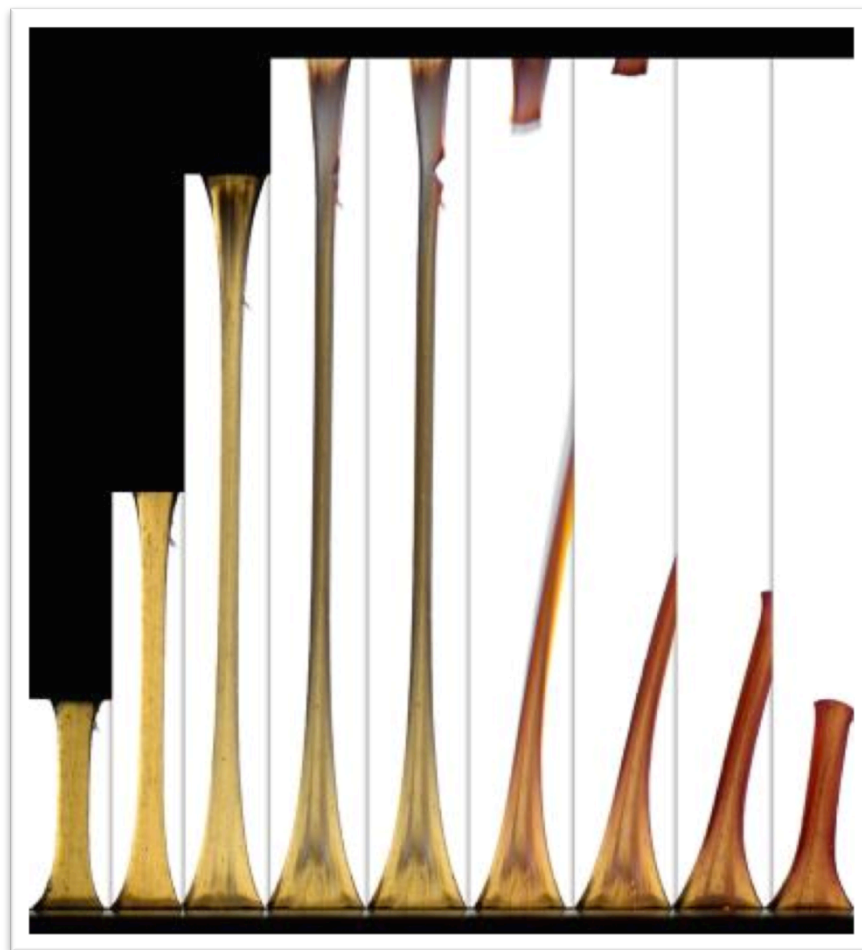
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# *Mechanophores*

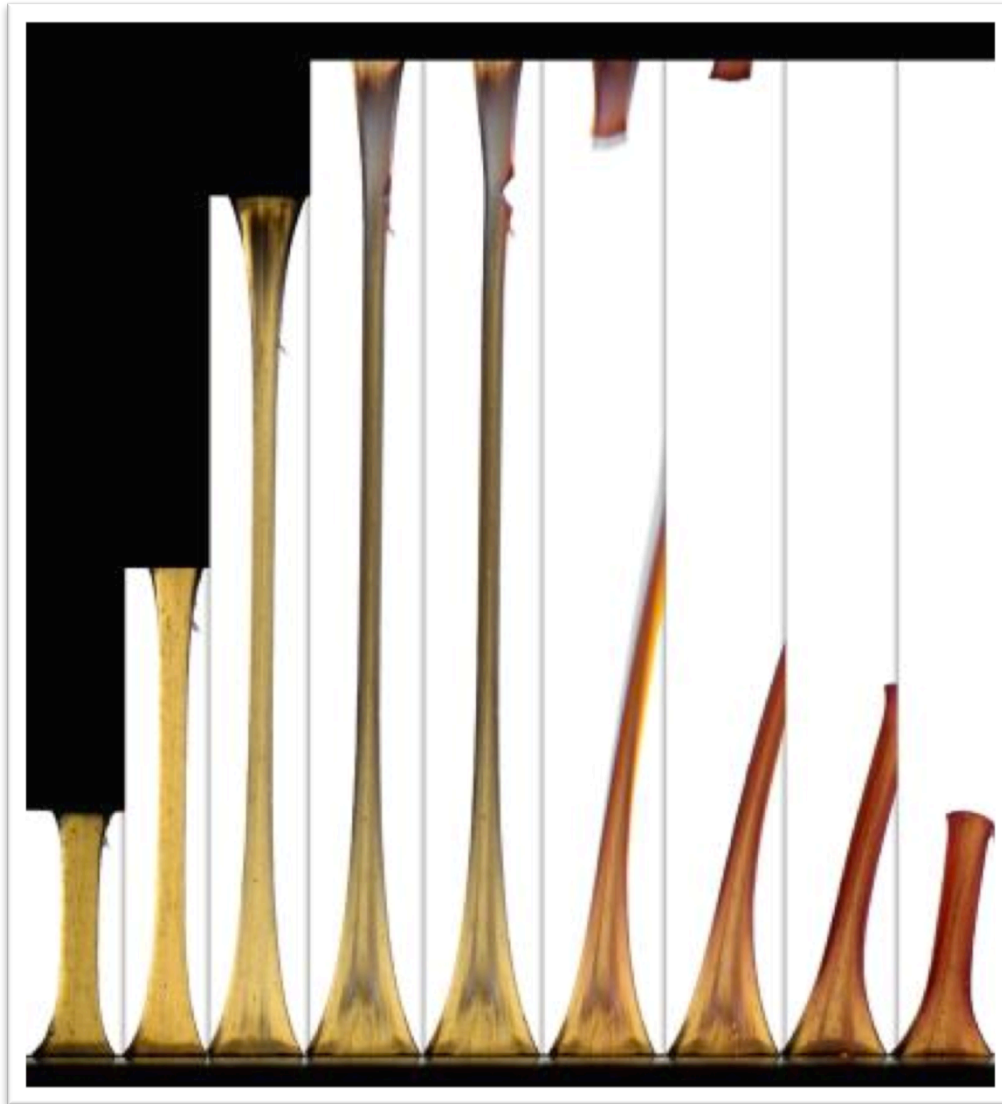
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## *Definition*

- Mechanically active molecules whose reactions are triggered by mechanical force



# *Mechanophores*



This shows progressive images of a mechanophore linked elastomer during tensile loading. After the polymer reaches a critical strain, a force-induced red color results from selective covalent bond cleavage in the mechanophore just prior to failure.



# *Mechanophores*

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## *How They Work*

- When undergoing mechanochemical change, spiropyrans (color-generating mechanophores) are capable of exposing certain levels of mechanical stress through turning into vivid colors, such as red or purple



# *Mechanophores*

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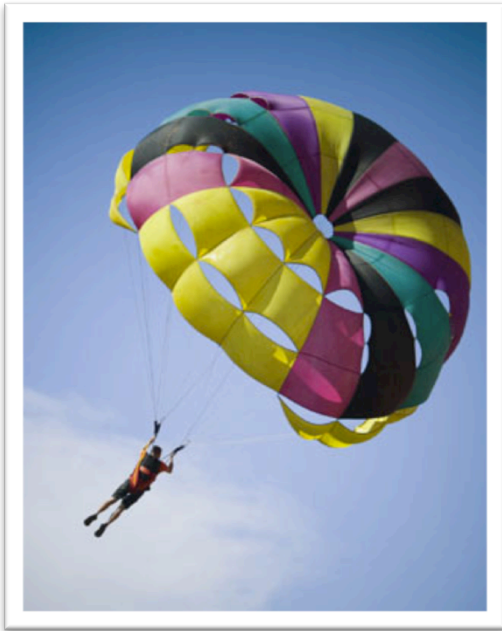
[http://  
www.physorg.com/  
news160834918.html](http://www.physorg.com/news160834918.html)

This video shows the force-induced color change in a mechanophore cross-linked polymer bead under compressive loading (left) and corresponding force-displacement curve (right).

# *Mechanophores*

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*They Can Be Used For*



Parachute cords



Climbing rope



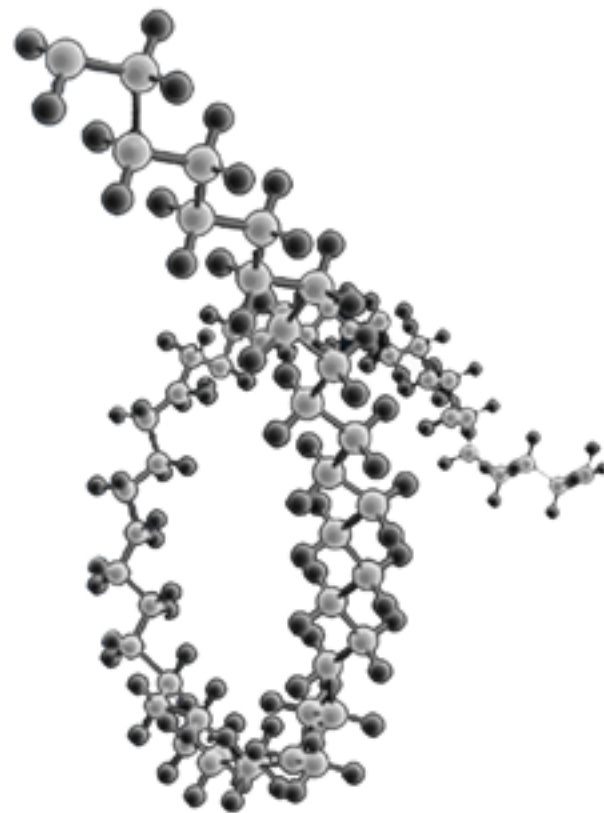
Bridges/Infrastructure

# *Polymer*

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## *Definition*

- A large macromolecule composed of repeating structural units
- Encompasses a large class of compounds comprising natural and synthetic materials

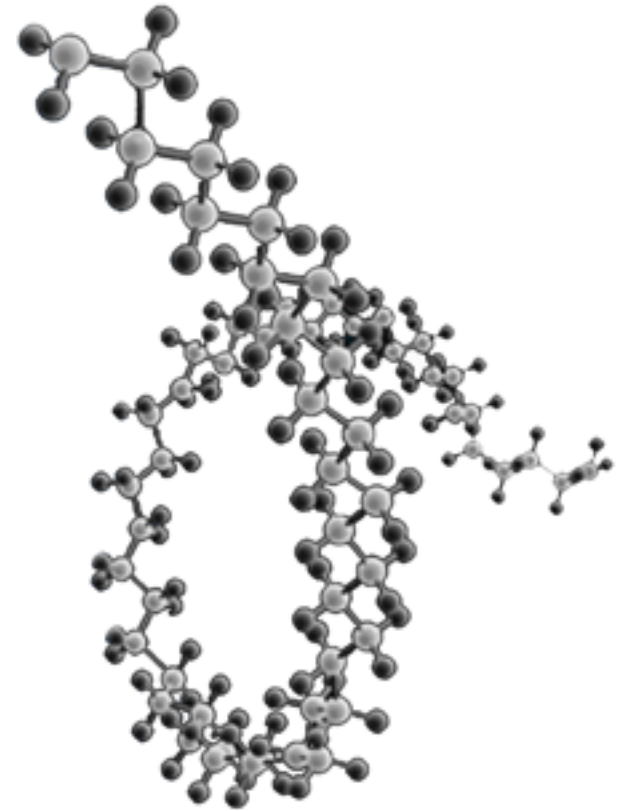


# *Polymer*

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## *Examples*

- Synthetic: Nylon, Polyethylene, Polyester, Teflon
- Natural: Silk, Wool, DNA, Cellulose, Proteins

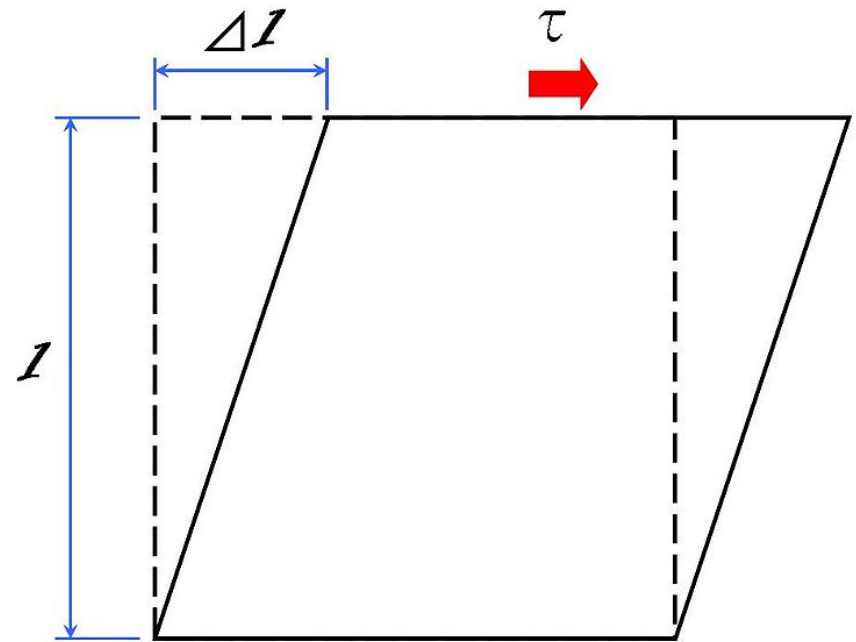


# Shear Stress

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## *Definition*

- The component of stress coplanar with a material cross section
- Arises from the force vector component parallel to the cross section



*PROJECT*

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# *Tunnel of Lights*

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## *Proposal*

Through the implementation of the newly developed mechanophore technology, I am proposing to build a tunnel of lights. While mechanophores have been made to give a visual indication of the slow process of strain throughout time, I am interested in speeding up this process in order to create a simple, yet visually stimulating experience.



# *Tunnel of Lights*

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## *Proposal*

I will do this through constructing a large glass tunnel with metal shear stress operators built within it. The operators will serve to quickly grind large quantities of mechanophore-injected polymer pieces. Each piece will momentarily light up as it is stressed. As viewers walk through the glass tunnel, they will experience the continuous flashing of lights as pieces of polymer within the tunnel are being continuously broken.

# *Tunnel of Lights*

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## *Materials*

- Location: Large and empty warehouse with dimmed lights
- Structure: Glass tunnel
- Shear Stress: Metal Shear Stress Operators
- Polymer: Polyethylene

# *Tunnel of Lights*

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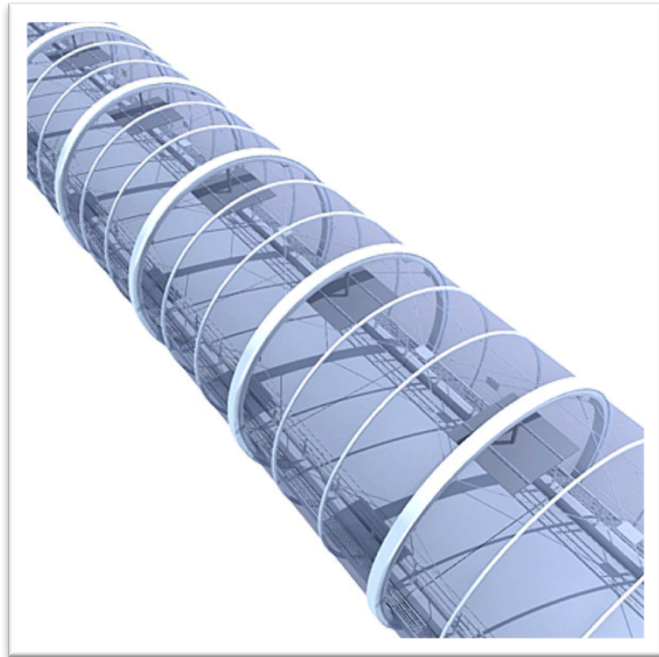
*Location: Large Empty Warehouse*



# *Tunnel of Lights*

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*Structure: Tunnel*



# *Tunnel of Lights*

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*Shear Stress Operators*

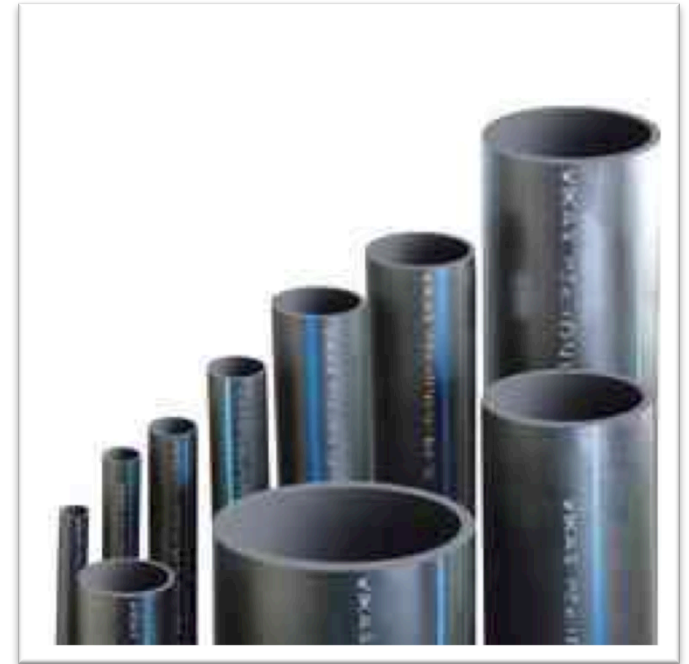




# *Tunnel of Lights*

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*Polymer: Polyethylene*



# *Tunnel of Lights*

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# *Tunnel of Lights*

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# *Tunnel of Lights*

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# *Tunnel of Lights*

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# *Tunnel of Lights*

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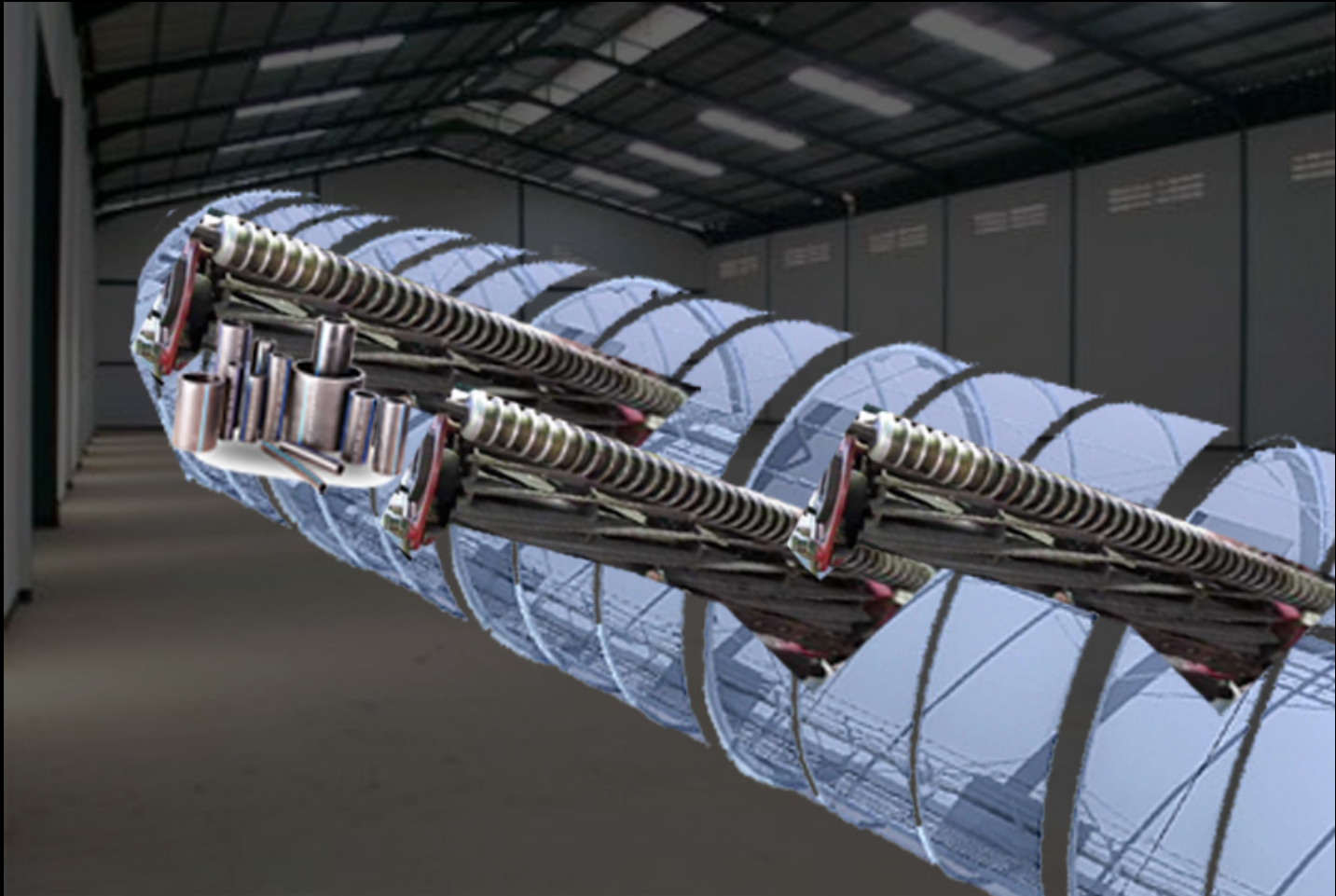
# *Tunnel of Lights*

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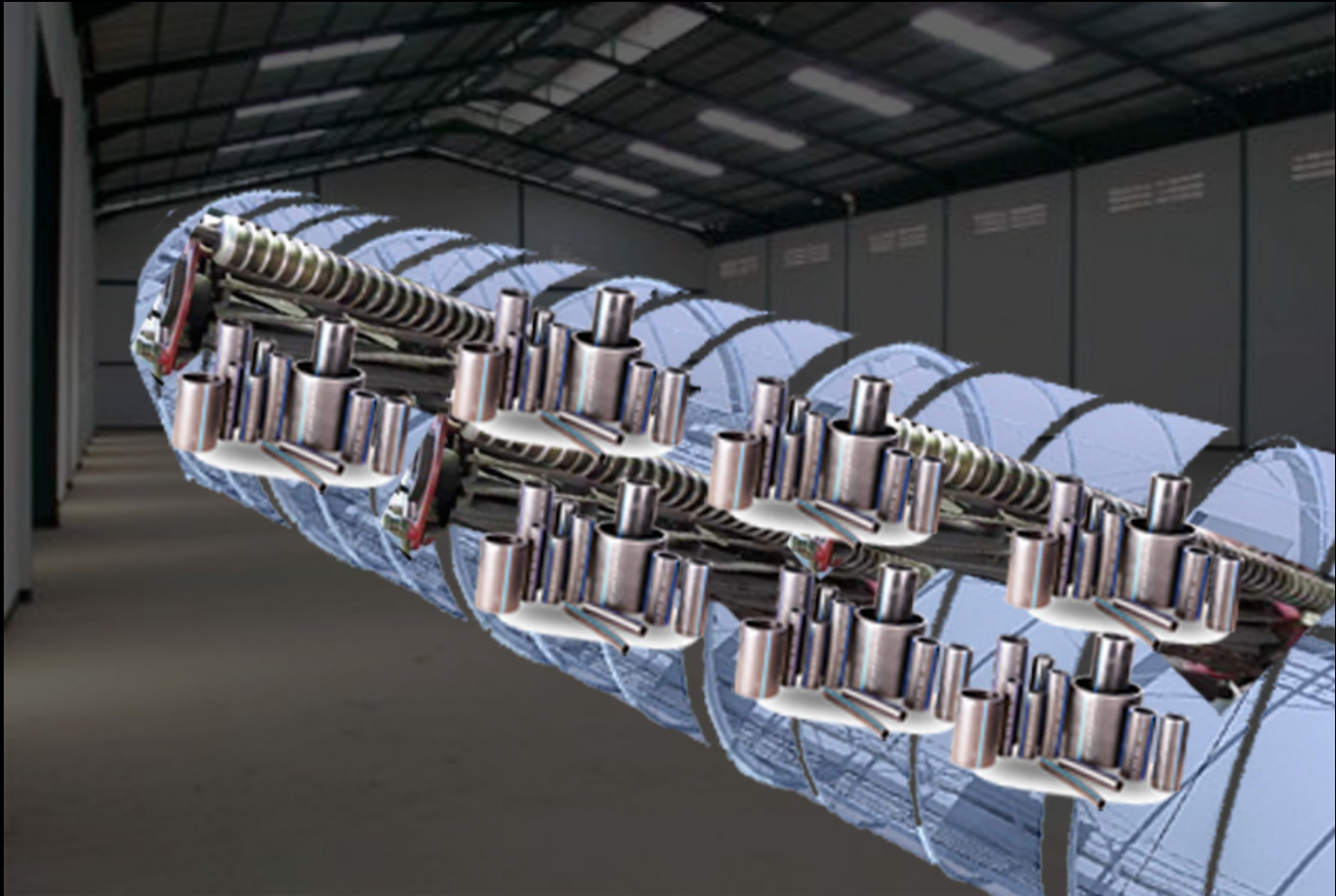
# *Tunnel of Lights*

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# *Tunnel of Lights*

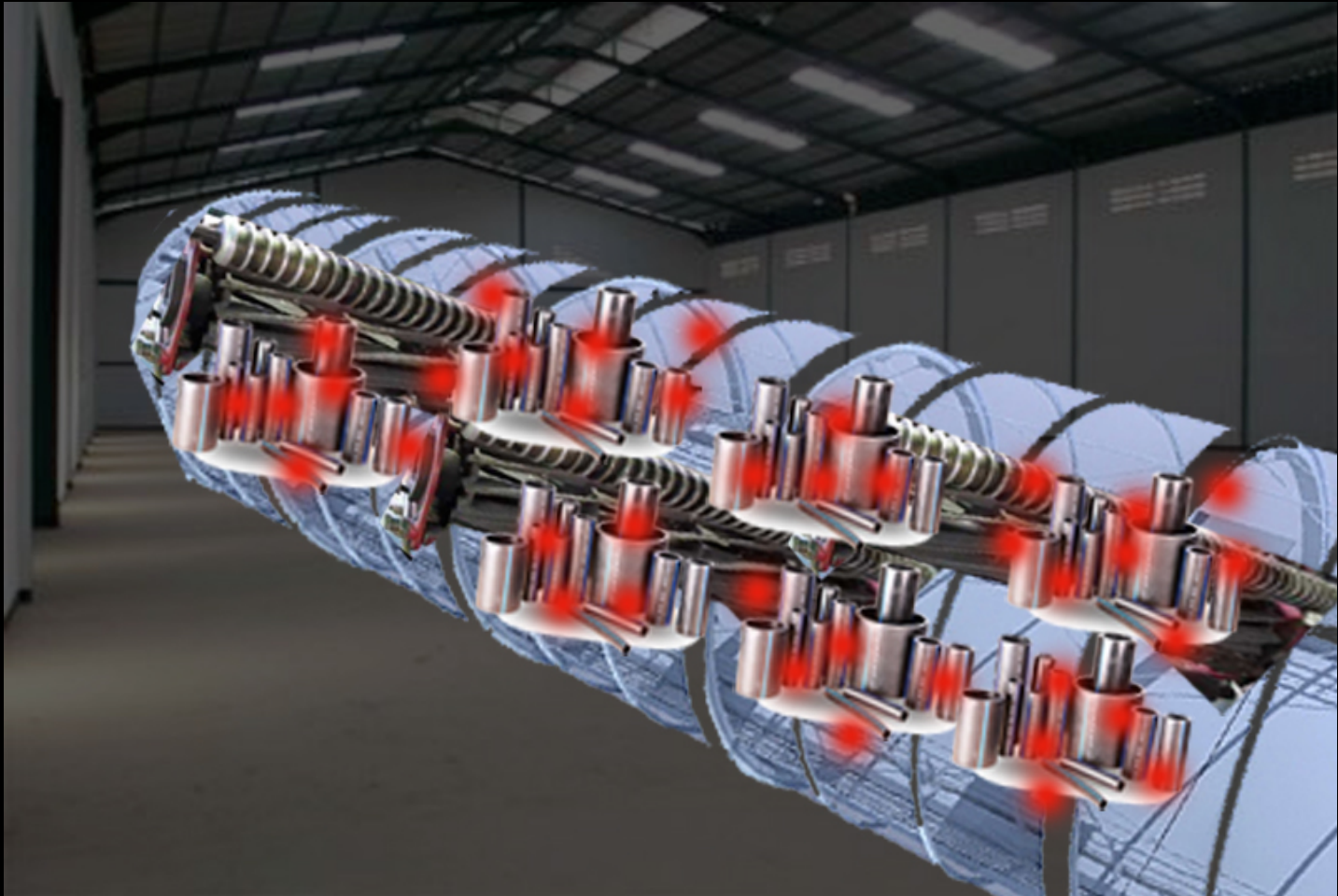
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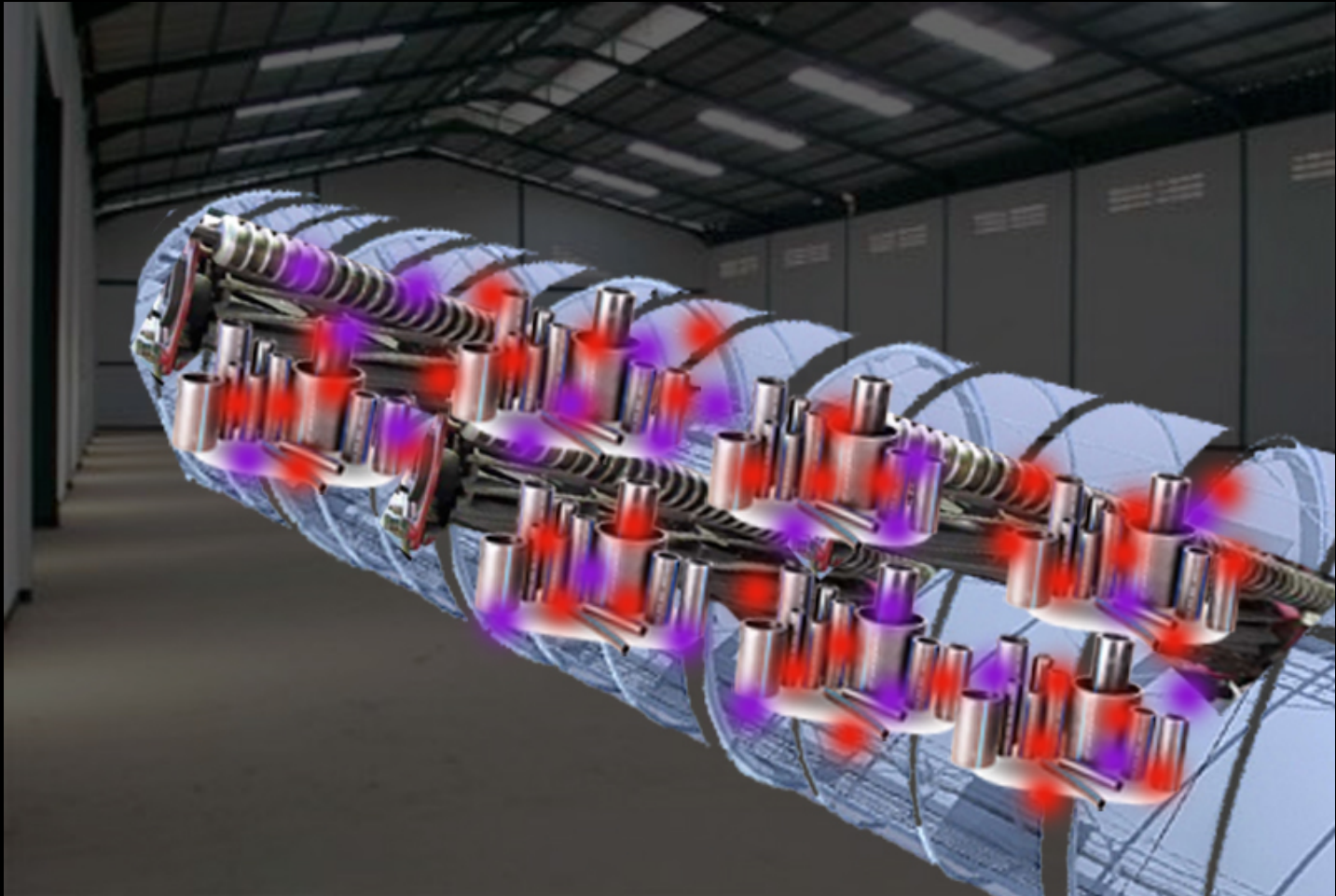
# *Tunnel of Lights*

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# *Tunnel of Lights*

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# *Sources*

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- <http://engineering.illinois.edu/news/2011/02/01/mechanophores-makes-popular-mechanics-top-ten>
- <http://news.illinois.edu/news/09/0506polymers.html>
- <http://www.physorg.com/news160834918.html>
- <http://en.wikipedia.org/wiki/Polymer>
- [http://gelfand.web.cmu.edu/scimodules/3. Natural vs synthetic polymers.html](http://gelfand.web.cmu.edu/scimodules/3._Natural_vs_synthetic_polymers.html)
- [http://en.wikipedia.org/wiki/Shear stress](http://en.wikipedia.org/wiki/Shear_stress)