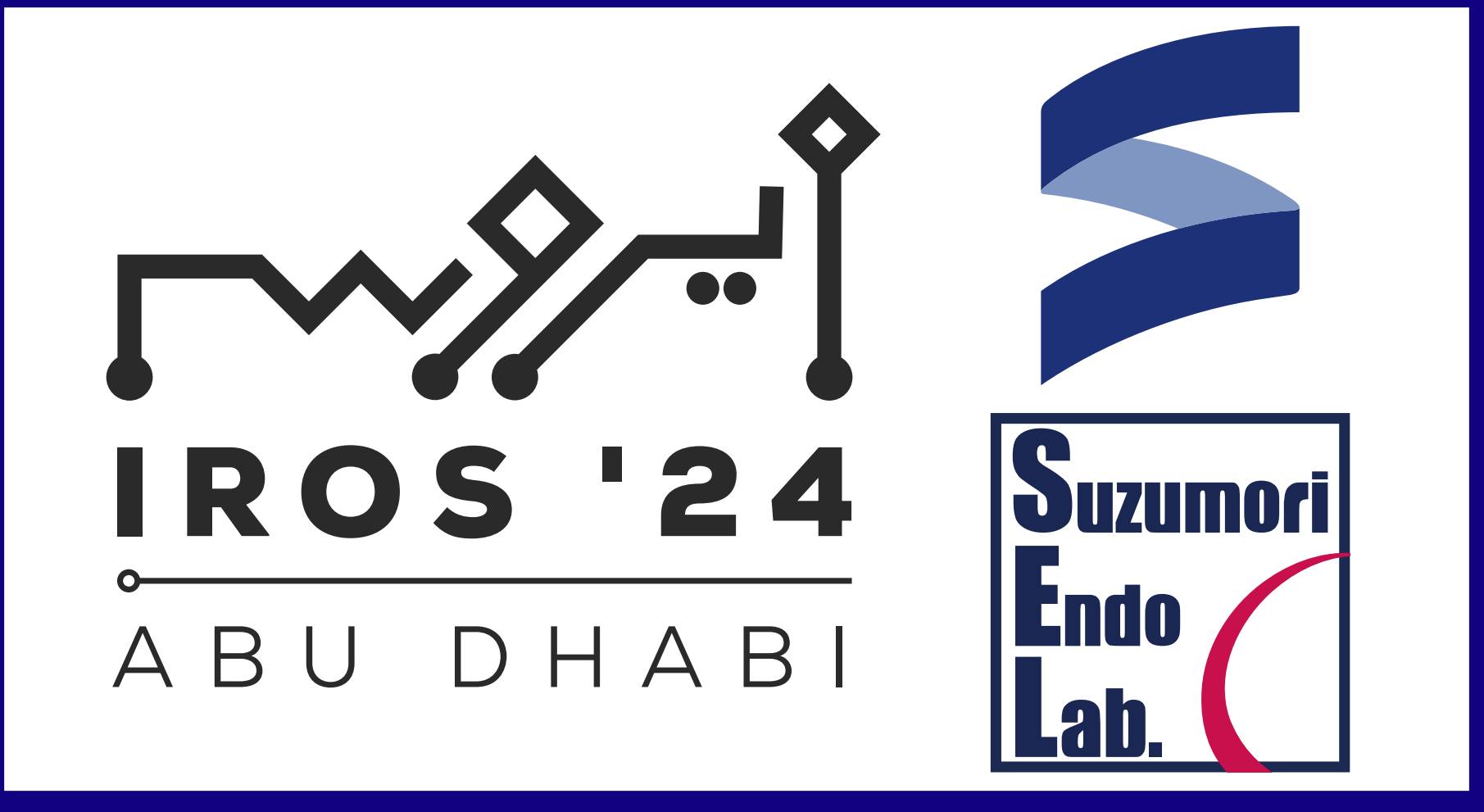


論文 / 著書情報  
Article / Book Information

Title	A Novel Soft Robot Can Close and Heal Large-Scale Damages Assisted by Thin McKibben Muscles
Authors	Mengfei Xie, Yunhao Feng, Hiroyuki Nabae, Koichi Suzumori
Citation	Workshop IEEE IROS 2024 Self-healing and Damage Resilient Soft Robots
Pub. date	2024, 10

# A Novel Soft Robot Can Close and Heal Large-Scale Damages Assisted by Thin McKibben Muscles

Mengfei Xie, Yunhao Feng, Hiroyuki Nabae, and Koichi Suzumori  
Department of Mechanical Engineering, Institute of Science Tokyo

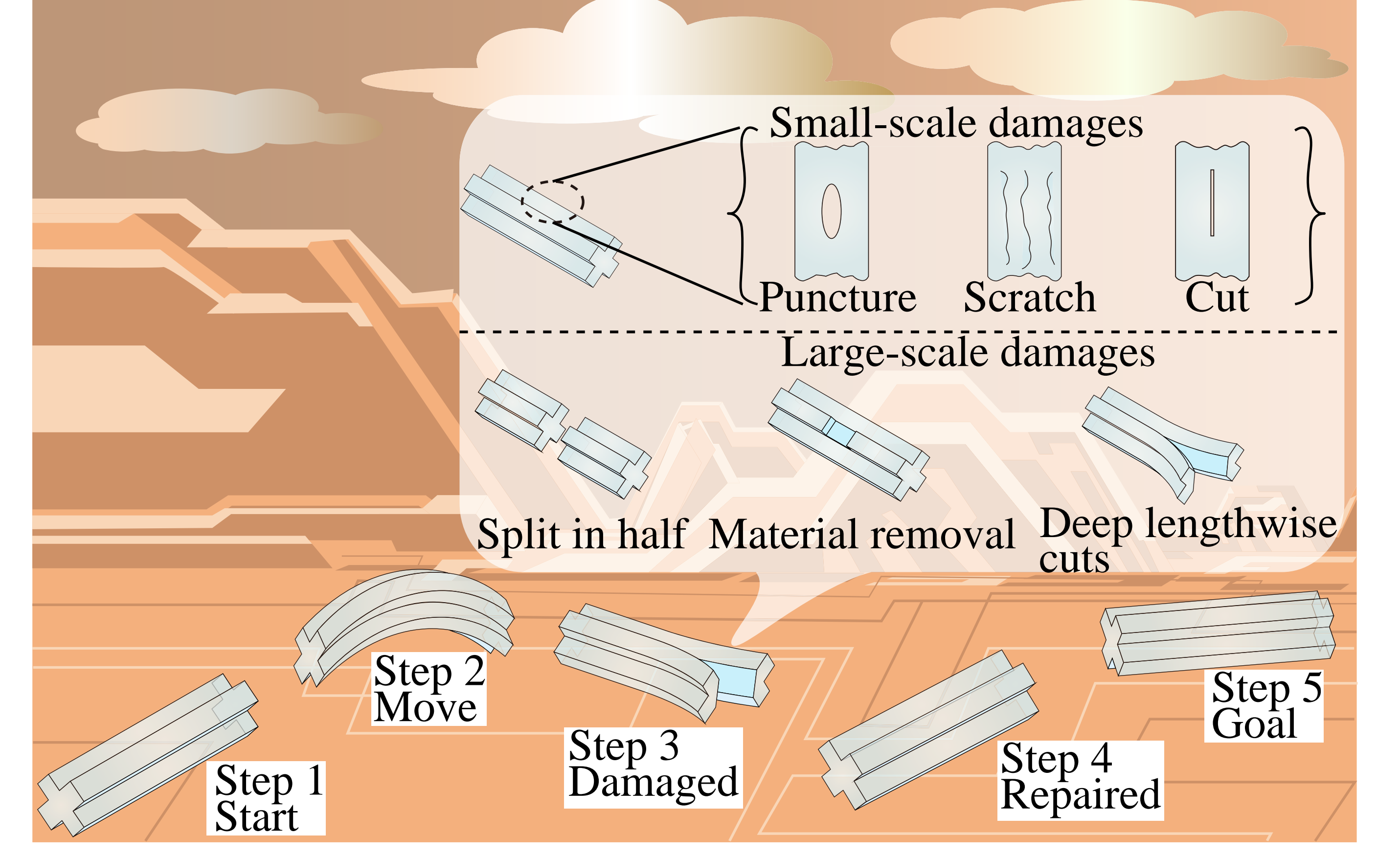


## Abstract A novel soft robot can repair the large-scale damage without external intervention.

### Background

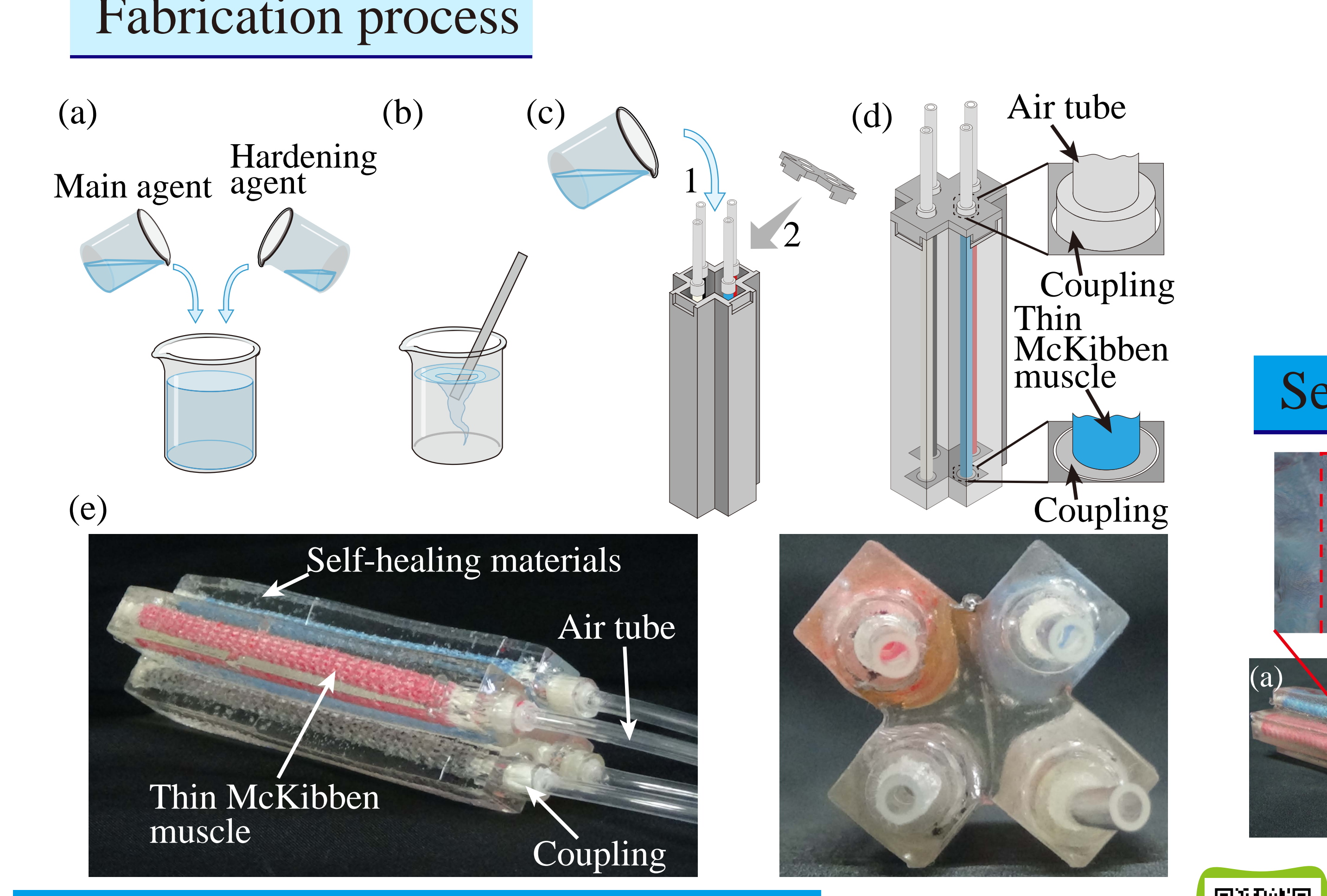
For relatively small-scale damages, it can naturally reconnect the cut surfaces, making recovery easy[1], [2]. However, for **large-scale damages**, naturally rejoining the cut surfaces is difficult[3], [4]. **Manual intervention is still required.**

→ **A novel robot that can self-repair two representative large-scale damages (material removal and deep lengthwise cuts) without external intervention.**

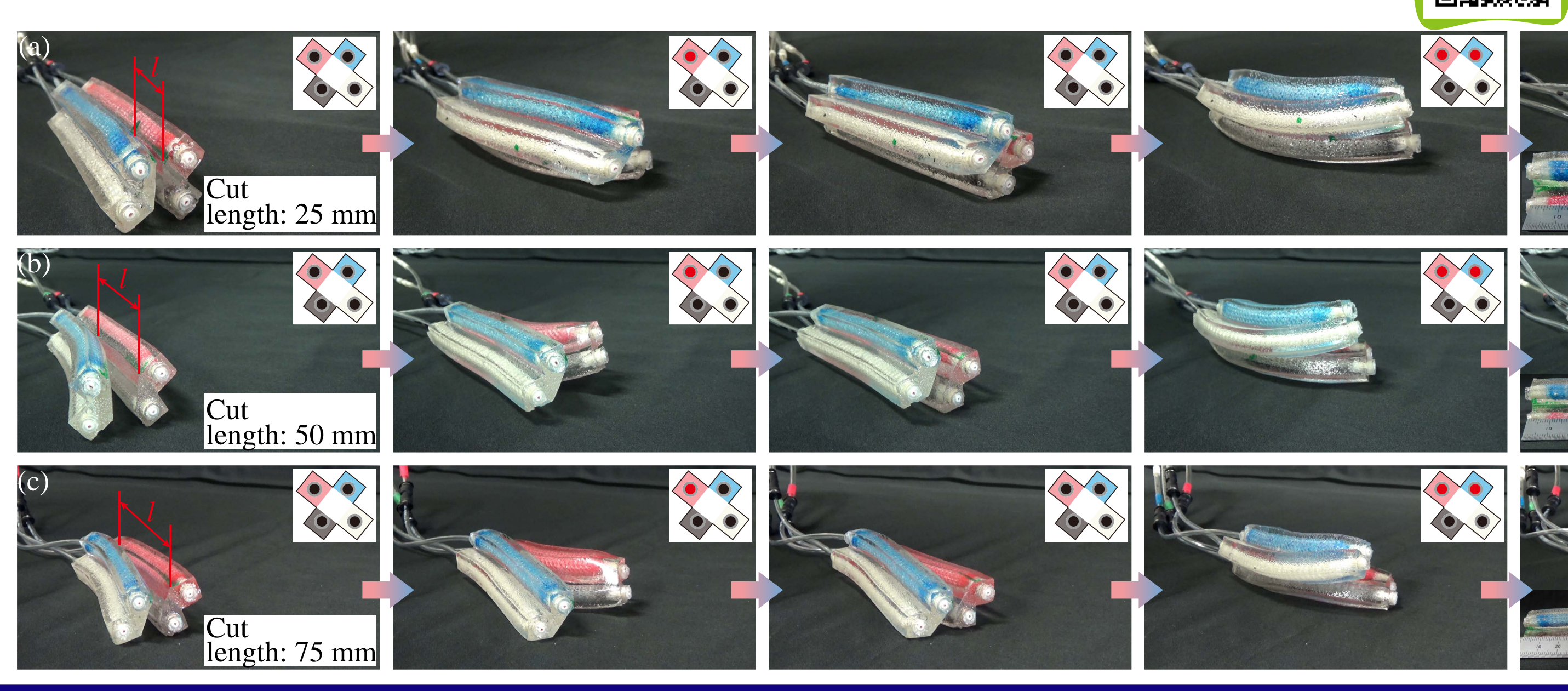


[1] R. F. Shepherd et al, "Soft machines that are resistant to puncture and that self seal," Adv. Mater., vol. 25, pp. 6709–6713, 2013.  
 [2] S. Terryn et al, "Self-healing soft pneumatic robots," Sci. Robot., vol. 2, no. 9, 2017, Art. no. eaan4268.  
 [3] S. Terryn et al, "Room temperature self-healing in soft pneumatic robotics: Autonomous selfhealing in a diels-alder polymer network," IEEE Robot. Automat. Mag., vol. 27, no. 4, pp. 44–55, Dec. 2020.  
 [4] S. K. Tabrizian et al., "Assisted damage closure and healing in soft robots by shape memory alloy wires," Sci. Rep., vol. 13, no. 1, 2023, Art. no. 8820.

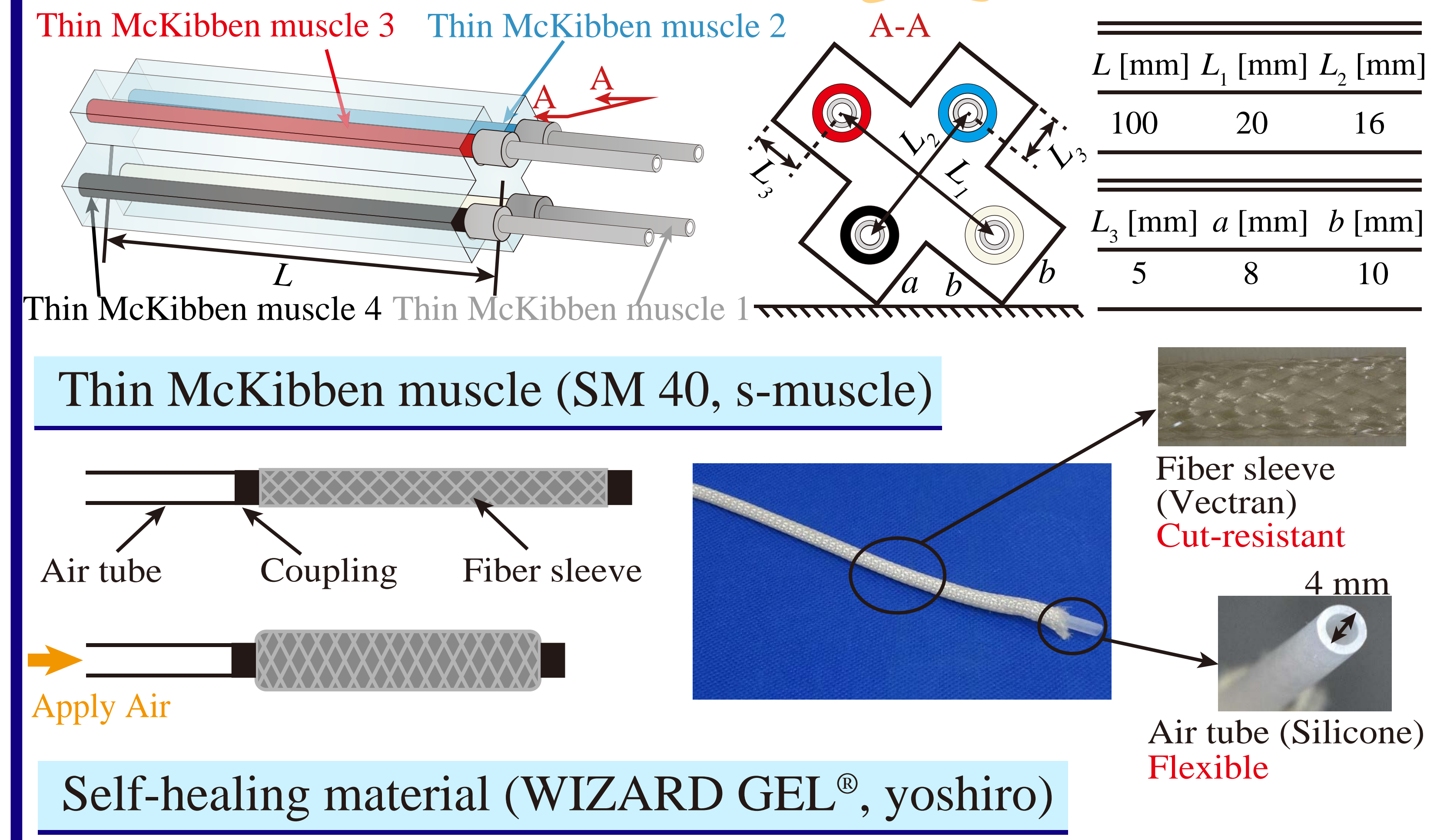
### Demonstration



#### Self-heal after deep lengthwise cuts



### Prototype

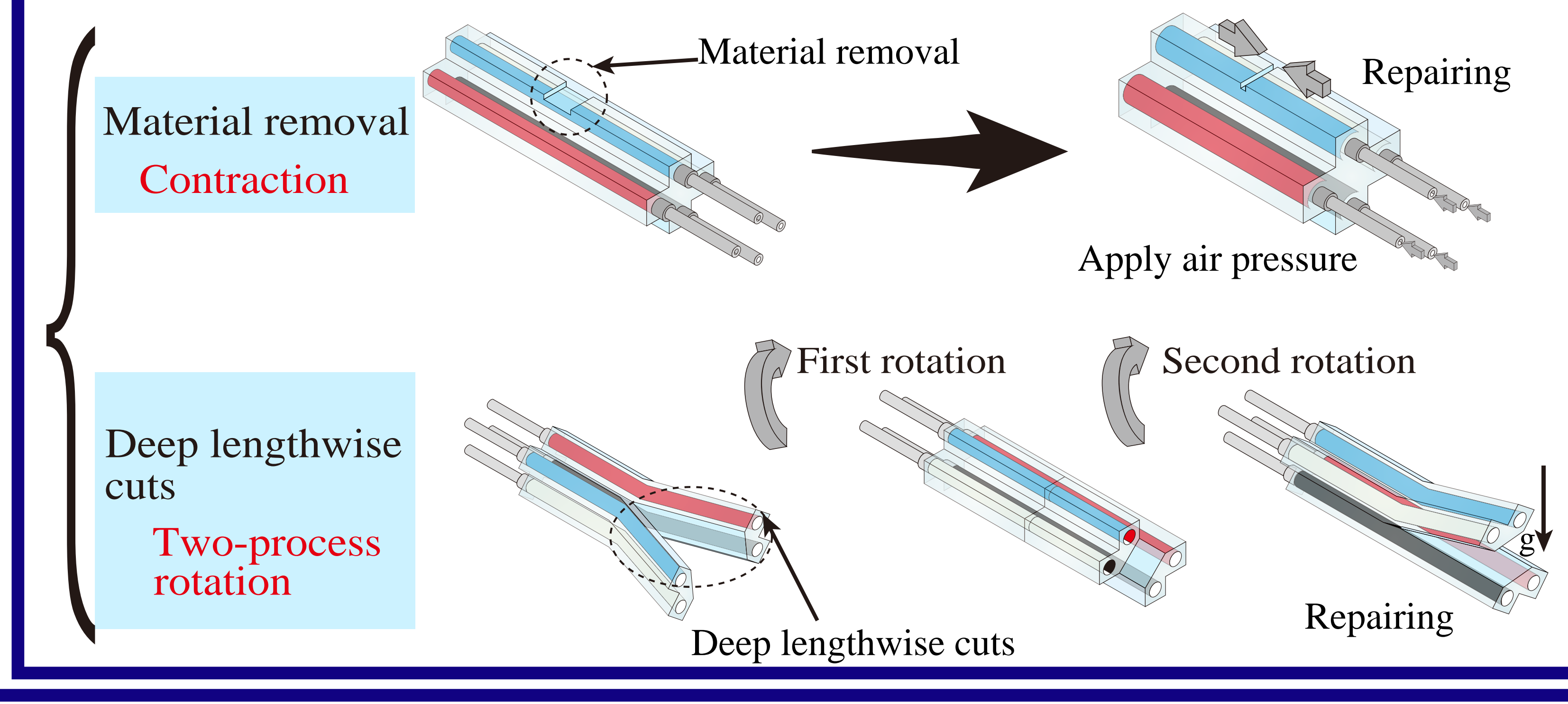


#### Self-healing material (WIZARD GEL®, yoshiro)

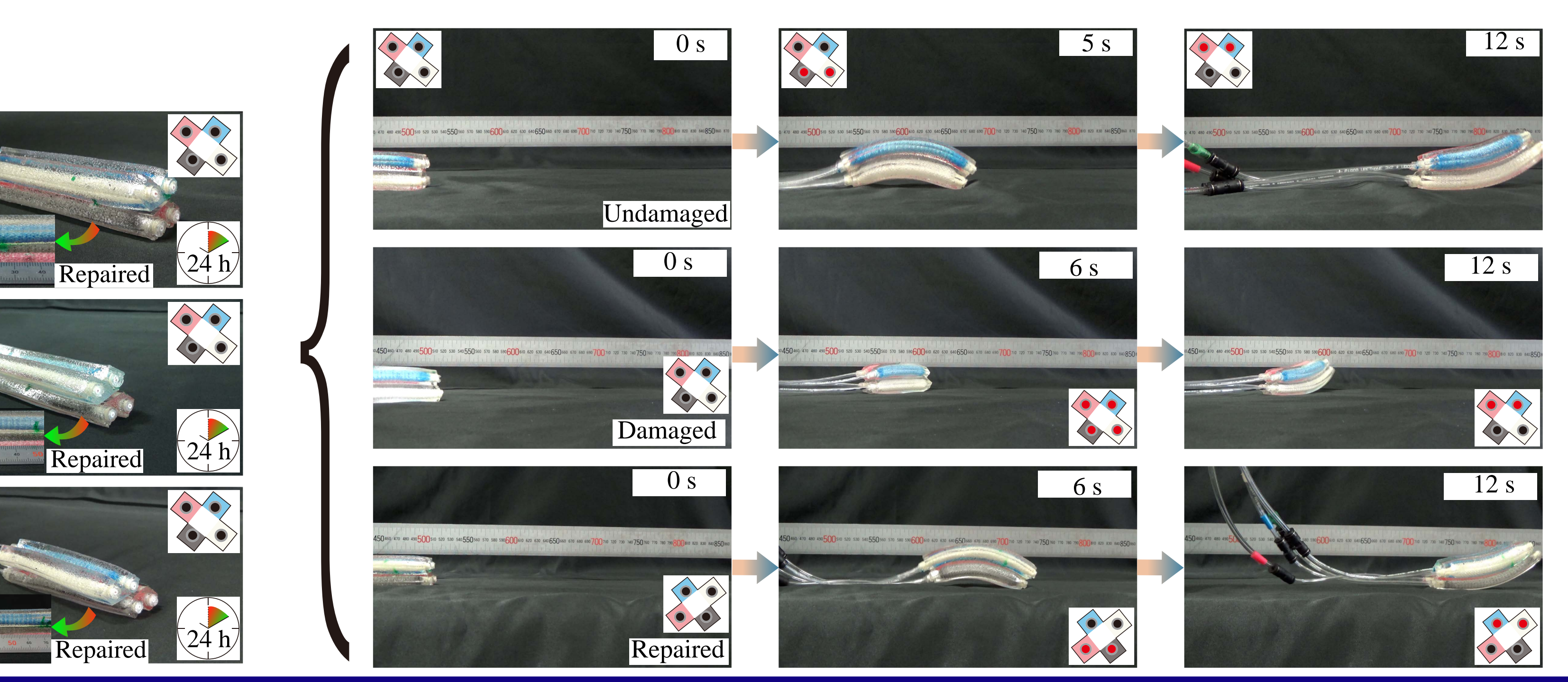
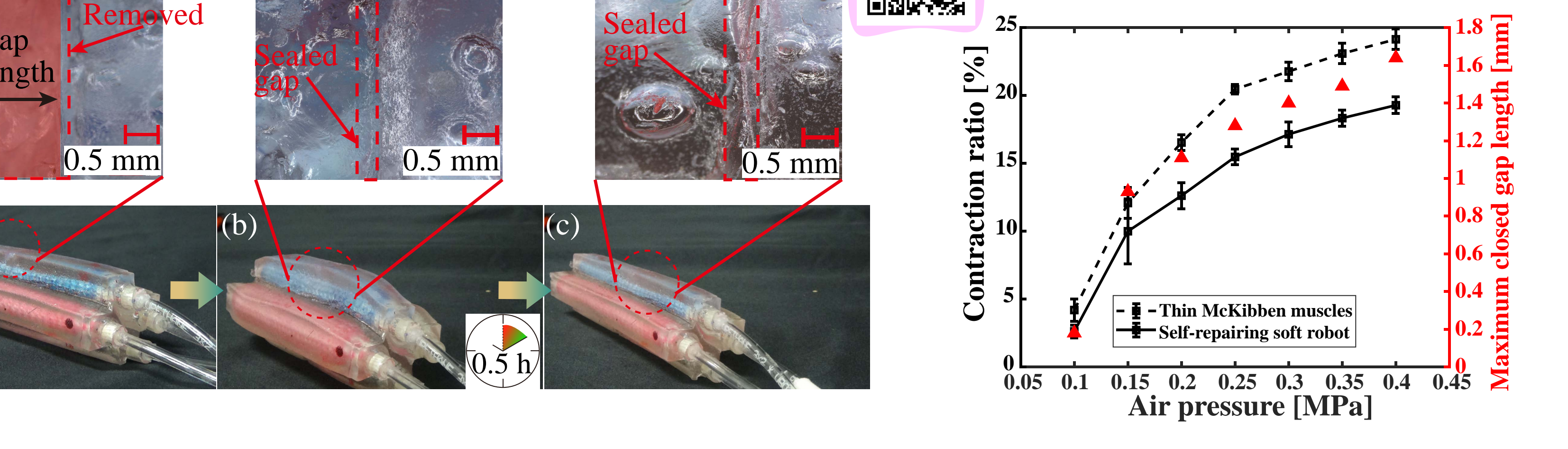
Items	Typical values
Appearance	transparency
Time of healing	24 h
Hardness	40 point
Tensile strength	0.24 MPa
Elongation	600–1000%
Dry resistance	6 months
Durability temp.	-18°C~105°C

\* From: <https://www.yushiro.co.jp/products/wizard>

#### Close and heal large-scale damages



#### Self-heal after material removal



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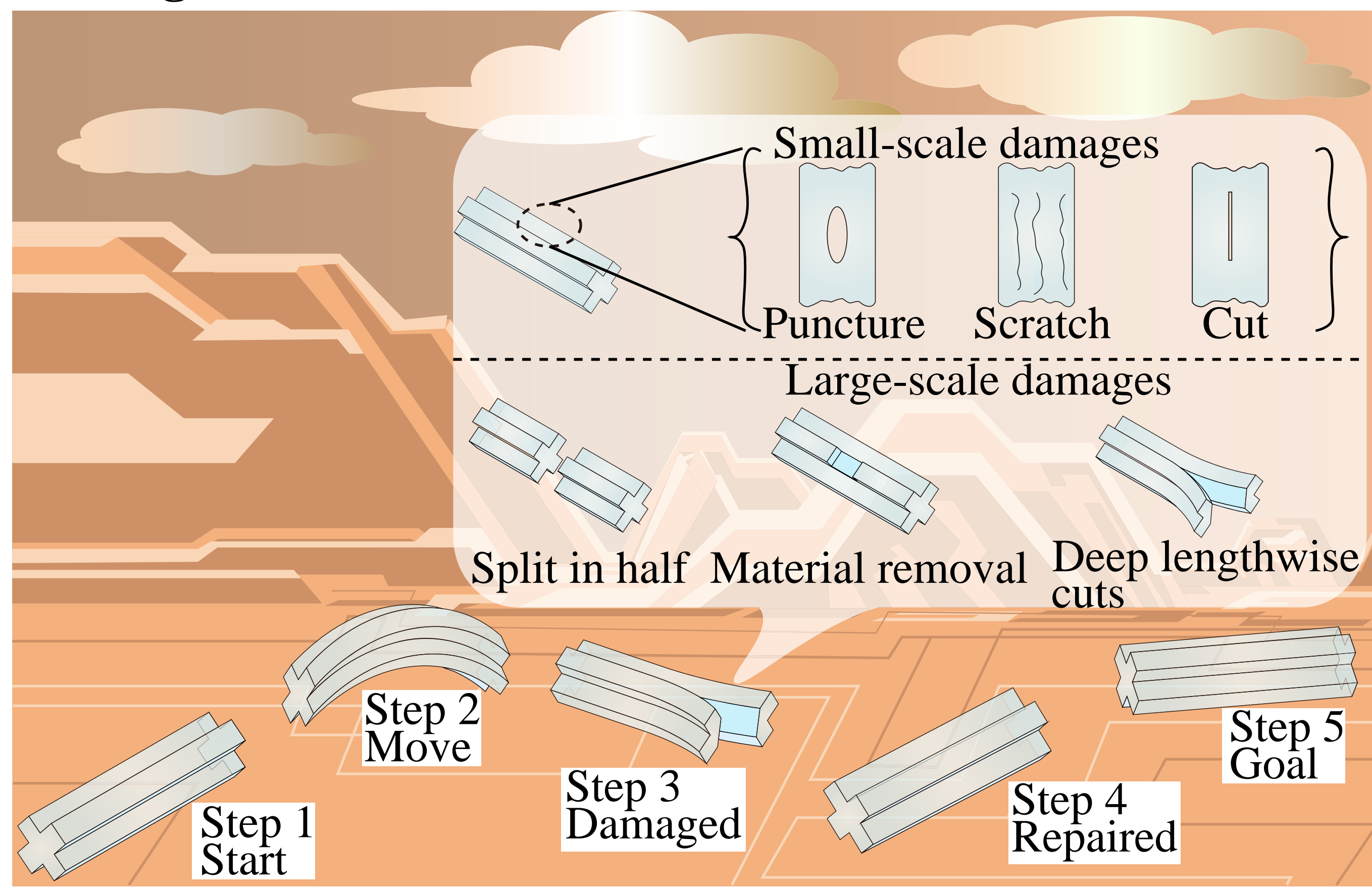
## Abstract

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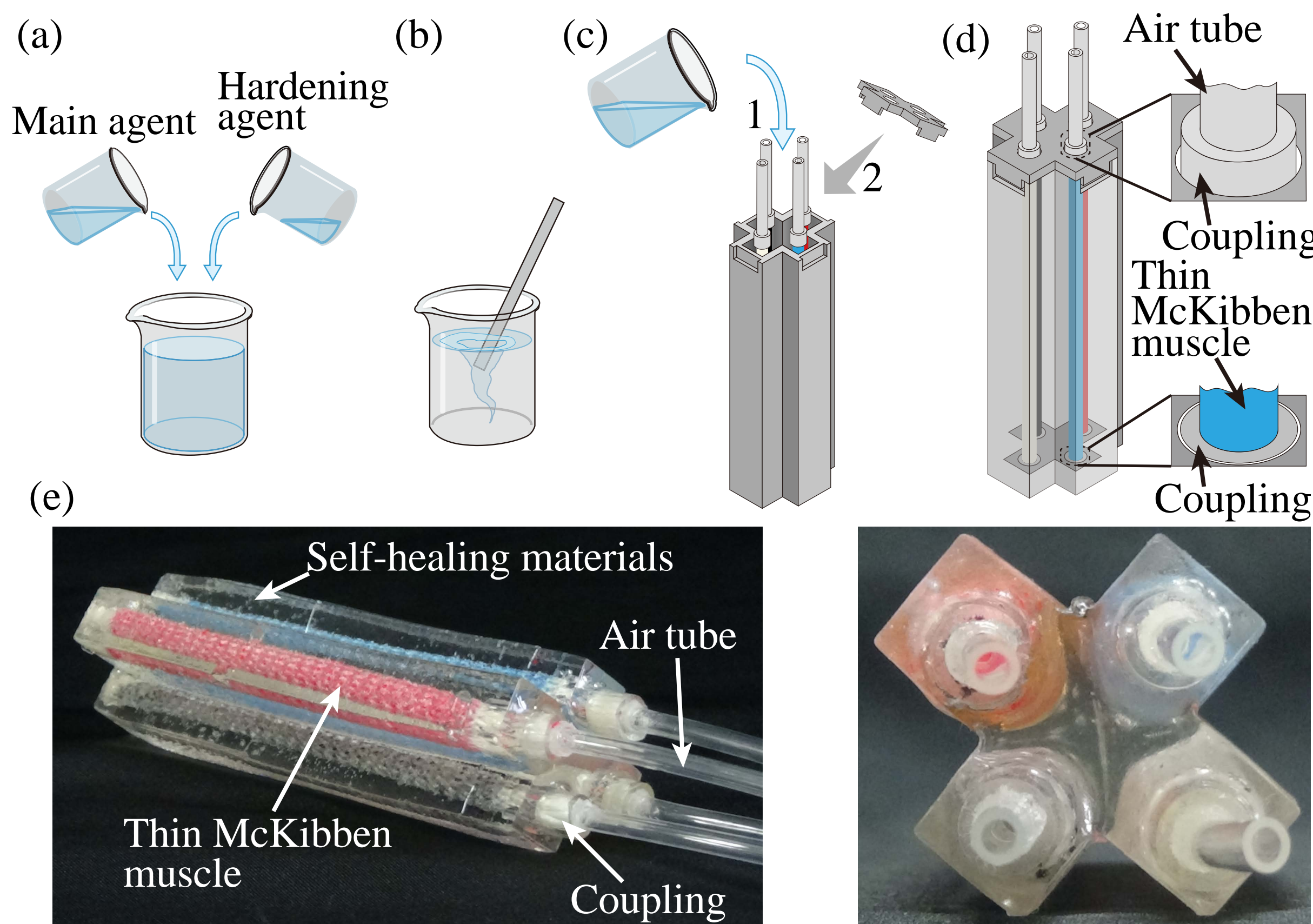
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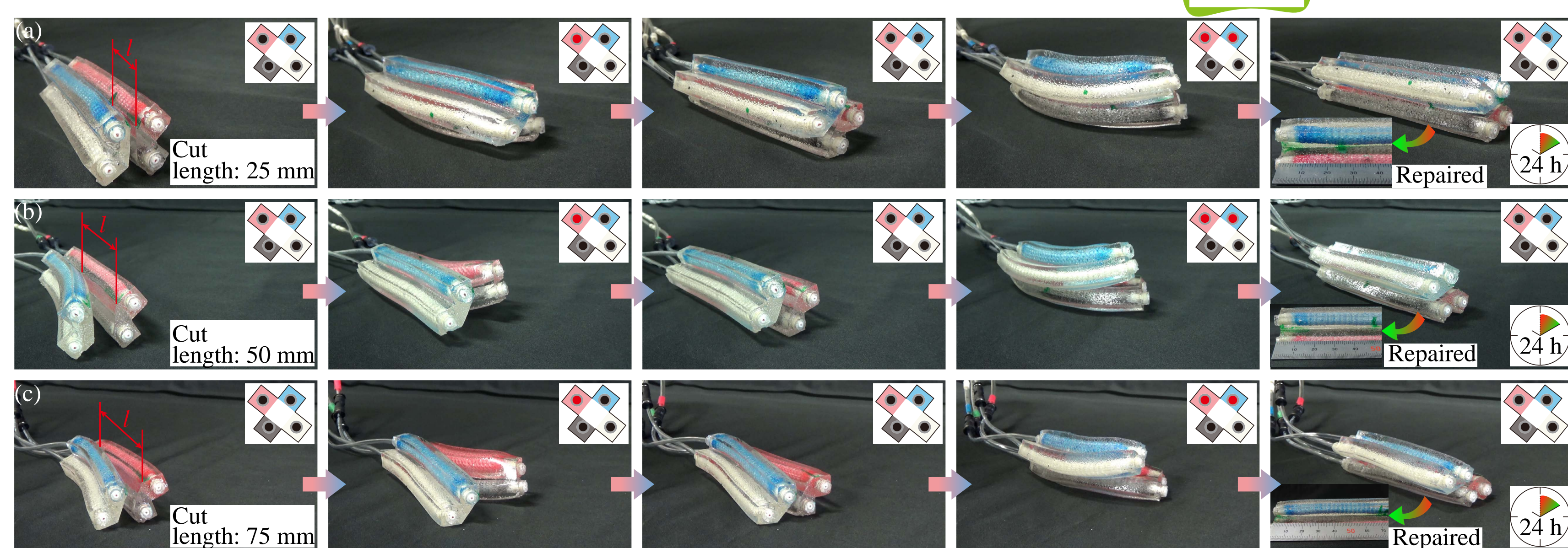
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## Demonstration

### Fabrication process

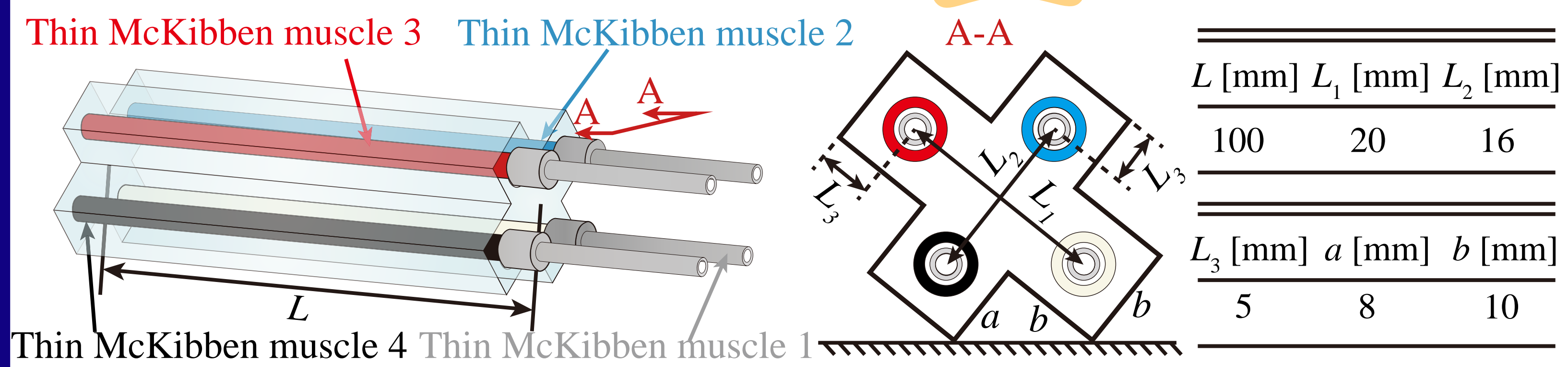


### Self-heal after deep lengthwise cuts



## Prototype

More information



### Thin McKibben muscle (SM 40, s-muscle)



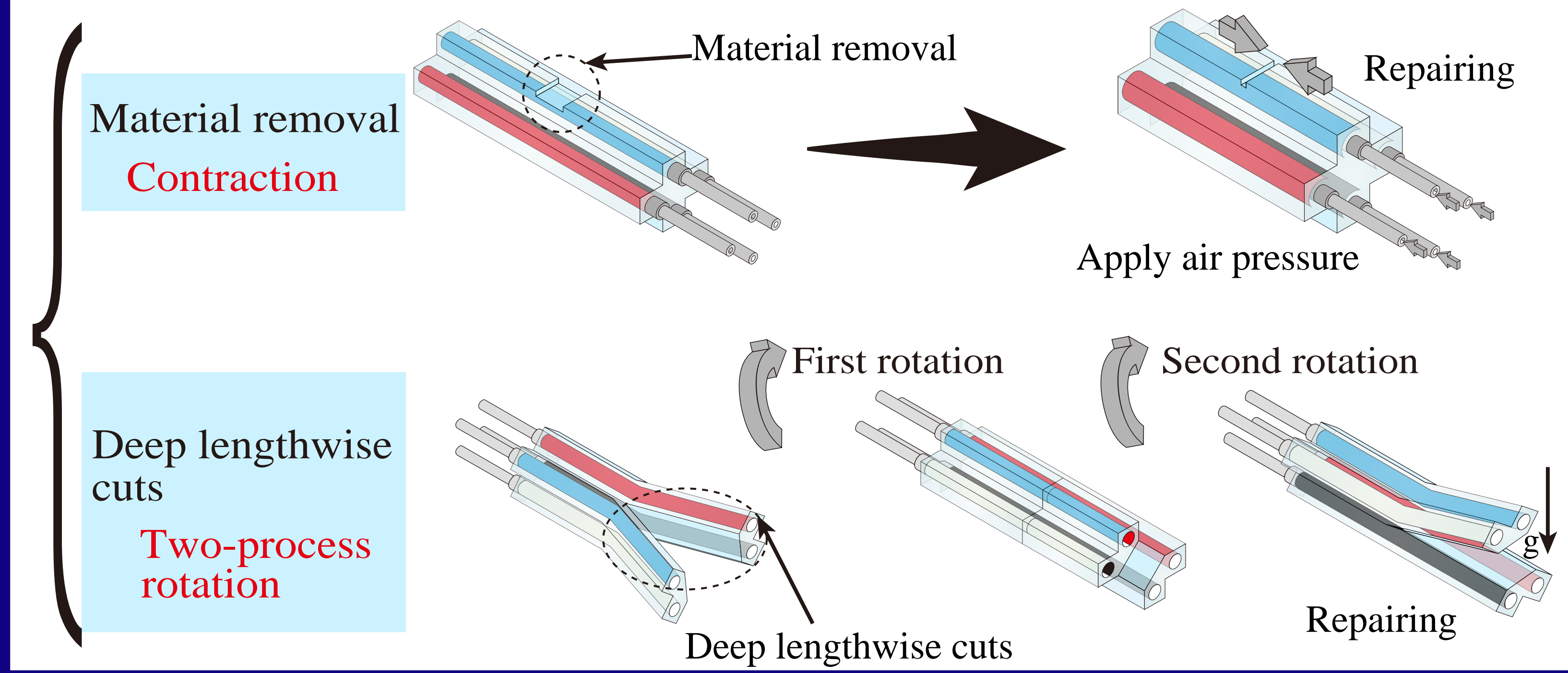
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### Close and heal large-scale damages



### Self-heal after material removal

