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# Revolutionizing Robotics: Advanced Electrodehesive Clutches for Wearable Tech

## Description

The research team recently published their paper, "[High Performance Electrodehesive Clutches with Multilayered Architecture](#)," in the journal *Science Advances* on February 14. Colgate served as the corresponding author, while [Bekir Aksoy](#), a postdoctoral researcher at the [Center for Robotics and Biosystems](#), was the first author.

Despite their unique advantages for robotics and human-computer interfaces, electrodehesive (EA) clutches are often plagued by uneven force distribution, which leads to failures when engaged. To tackle this issue, the team employed advanced imaging techniques that allowed them to observe the clutch's deformation in real time.

"We discovered that uneven force distribution was the primary cause of failure," Aksoy explained. "To address this, we reimagined the clutch with a multilayer structure and incorporated a soft interlayer that facilitates stress distribution."

Although the new design decreased stress on the front side, it caused peeling at the back. In response, the team extended the adhesion layer, creating a "tail" that evenly dissipated stress and prevented this peeling phenomenon.

The improved clutch design can now exert 22 Newtons of force over a 1 cm<sup>2</sup> area at just 100 volts. This surpasses the performance of similar devices on the market, as it minimizes energy loss by utilizing the deformation of the soft layer instead of relying on slipping mechanisms.

Aksoy noted, "This advancement not only enhances the clutch's force output but also significantly boosts energy efficiency, vital for applications demanding low power consumption." One promising application is a lightweight wearable device for finger rehabilitation, which aids recovery from conditions such as stroke and arthritis. The potential of this technology continues to excite the team as they explore its applications across robotics, healthcare, and consumer devices.



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## Vocabulary List:

1. **Electroadhesive** /,ɪlɛk.trəʊ.ə'di:.sɪv/ (adjective): Relating to adhesion through electrical means.
2. **Deformation** /,di:.fɔ:'meɪ.fən/ (noun): The alteration of the shape or size of an object under stress.
3. **Multilayered** /,mʌl.ti'leɪ.ərd/ (adjective): Composed of several layers.
4. **Adhesion** /əd'hi:.ʒən/ (noun): The ability of dissimilar substances to stick to each other.
5. **Dissipated** /'dɪs.ɪ.peɪ.tɪd/ (verb): Dispersed or scattered in various directions.
6. **Efficiency** /ɪ'fɪʃ.ən.si/ (noun): The ability to accomplish a task with minimal waste of time and resources.

## Comprehension Questions

### Multiple Choice

1. Who served as the corresponding author for the paper on High Performance Electro adhesive Clutches with Multilayered Architecture?  
Option: Colgate  
Option: Bekir Aksoy  
Option: Ratan Naval Tata  
Option: Center for Robotics and Biosystems
2. What was the primary cause of failure for electro adhesive clutches mentioned in the text?  
Option: Uneven force distribution  
Option: Soft interlayer  
Option: Peeling phenomenon  
Option: Slipping mechanisms
3. How much force can the improved clutch design exert over a 1 cm<sup>2</sup> area at 100 volts?  
Option: 15 Newtons  
Option: 22 Newtons  
Option: 30 Newtons  
Option: 50 Newtons
4. What application was mentioned as a promising use for the lightweight wearable device?  
Option: Dance performance enhancement  
Option: Cooking assistance



- Option: Finger rehabilitation
- Option: Swimming coaching

5. What did the team do to prevent the peeling phenomenon at the back of the clutch?

- Option: Reduced voltage input
- Option: Extended the adhesion layer
- Option: Removed the soft interlayer
- Option: Increased the clutch size

6. What is a key advantage of the new clutch design in terms of energy efficiency?

- Option: Higher energy consumption
- Option: Utilizing slipping mechanisms
- Option: Minimizing energy loss
- Option: Increasing force output

### True-False

- 7. Electroadhesive clutches are free from issues related to uneven force distribution.
- 8. The improved clutch design utilizes slipping mechanisms for energy efficiency.
- 9. The team created a tail to prevent the peeling phenomenon at the back of the clutch.
- 10. The lightweight wearable device is designed for ankle support.
- 11. The new clutch design enhances force output but reduces energy efficiency.
- 12. The improved clutch design can exert 20 Newtons of force at 100 volts.

### Gap-Fill

14. The improved clutch design is capable of exerting 22 Newtons of force over a 1 cm<sup>2</sup> area at just

\_\_\_\_\_ volts.

15. According to Aksoy, the team discovered that uneven force distribution was the primary cause of failure



but addressed it by reimagining the clutch with a multilayer structure and incorporating a soft

\_\_\_\_\_.

16. Aksoy noted that the technology behind the clutch design is vital for applications demanding low

\_\_\_\_\_ consumption.

17. The team extended the adhesion layer to create a "tail" that evenly dissipated stress and prevented the

\_\_\_\_\_ phenomenon.

18. One promising application of the technology is a lightweight wearable device for finger

\_\_\_\_\_.

## Answer

**Multiple Choice:** 1. Colgate 2. Uneven force distribution 3. 22 Newtons 4. Finger rehabilitation 5. Extended the adhesion layer 6. Minimizing energy loss

**True-False:** 7. False 8. False 9. True 10. False 11. False 12. False

**Gap-Fill:** 14. 100 15. interlayer 16. power 17. peeling 18. rehabilitation

## Answer

### CATEGORY

1. Sci/Tech - LEVEL4

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