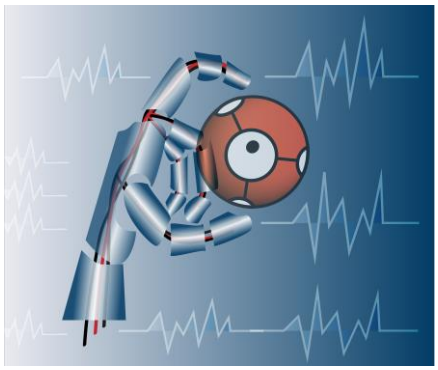
Dielectric elastomer actuator with dispersed liquid crystal

The Spanish National Research Council (CSIC) has developed a new generation of actuators based on an elastomeric matrix with dispersed liquid crystal droplets. These actuators exhibit a reversible and controllable response to external stimuli improving in some cases up to 10 times the response of the unmodified matrix. For their excellent performance these actuators are suitable for the manufacture of robotic, electronic and industrial devices or for biomedical components.

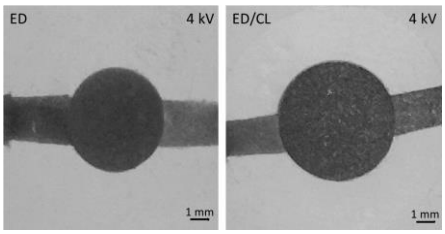
An industrial partner for a license agreement is sought

This material responds even at low voltages



Currently, dielectric elastomer actuators are promising materials from the industrial point of view since they present a large mechanical deformation by the application of an electric field. However, the need to apply high voltages sometimes limits the application of these materials since a modest response is observed when lower voltages are applied.

The actuators developed by a group of researchers of CSIC overcome this limitation since they exhibit improved performance even at low voltages. These actuators consist in a silicone matrix where a thermotropic liquid crystal (LC) is dispersed forming a second phase in droplet shape. These materials exhibit a response up to 35% when an electric field of 50 V/μm is applied. This response is 10 times higher than the response of base matrix. The new actuators are readily obtained by processes commonly employed in the industry.



Micrograph of dielectric elastomer showing the response at 4 kV without LC (left) and with LC (right).

Main applications and advantages

- **Improved performance** due to both an increase in dielectric permittivity of the system and a reduction in elastic modulus while maintaining or even increasing the breakdown potential of the system, resulting in an improved resistance to dielectric breakdown.
- **Viability of industrial scale-up** since these materials are processed by conventional processing methods of elastomers.
- **Wide range of applications** as these materials can be used in: industrial devices such as microvalves or robotic arms; electronic devices such as touch interfaces, ultra-thin speakers or lens positioners; biomedical components such as prosthesis or active dressing; or in wind and wave energy generators.

Patent Status

Spanish patent filed with possible international extension.

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