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Publication date:
2012

Document Version
Early version, also known as pre-print

Development of new PDMS based materials for dielectric electroactive polymers (DEAPs) as actuators and generators

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Dielectricelectro active polymers (DEAPs) are polymeric network systems that can be used to convert an electrical input to mechanical deformation of a polymer. DEAPs can be applied as actuators, sensors and generators due to their ability to exhibit a change in size and shape when an external voltage is applied as well as generate electrical energy when the material is exposed to mechanically induced deformations. DEAPs are normally constructed from thin filled elastomer films sandwiched between two compliant electrodes.[1] The working principle of a DEAP actuator can be seen in Figure 1.

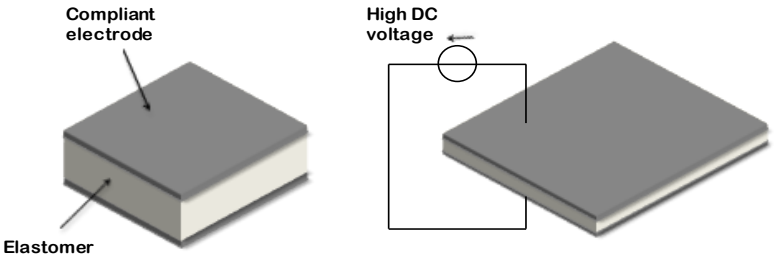

Figure 1: DEAP actuator working principle. When a high DC voltage is applied to the electrodes, the electrostatic pressure squeezes the elastomer film in thickness and the film is expanded in planar directions. When the external voltage is switched off, the elastomer film returns to its original shape.

Polydimethylsiloxane (PDMS) is one of the most used materials for DEAP applications due to its good thermal stability, high efficiency and fast response.[2]

The aim of this work is to design new PDMS networks applicable as DEAPs. One of the most important factors for DEAPs is the dielectric permittivity and development of novel materials are focused on increasing this while maintaining good mechanical properties. As PDMS is used for DEAP applications with good results, it is of interest to do material modification at the PDMS network cross-linking points as this could lead to improved material properties. Design of novel functional cross-linkers can for example allow for incorporation of selected moieties in the network structure (see Figure 2) which could increase the dielectric permittivity. Functional cross-linkers could also be used for investigation of the network formation and structure through labeling of cross-linking sites.

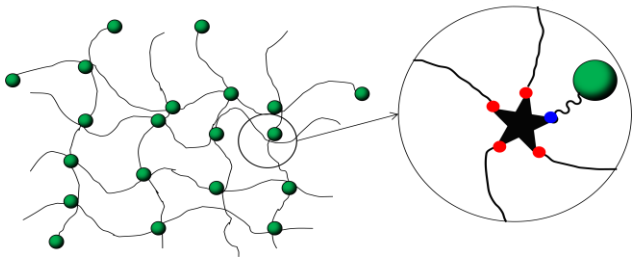

Figure 2: PDMS network with cross-linker and incorporated functionality.

References

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