

Technical University of Denmark



## Novel silicone compatible cross-linkers for controlled and well distributed functionalization of PDMS networks

Madsen, Frederikke Bahrt; Daugaard, Anders Egede; Hvilsted, Søren; Skov, Anne Ladegaard

*Publication date:*  
2012

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Bahrt, F., Daugaard, A. E., Hvilsted, S., & Skov, A. L. (2012). Novel silicone compatible cross-linkers for controlled and well distributed functionalization of PDMS networks. Abstract from 8th Annual Polymer Day, Kgs.Lyngby, Denmark.

## DTU Library

Technical Information Center of Denmark

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# Novel silicone compatible cross-linkers for controlled and well distributed functionalization of PDMS networks

Frederikke Bahrt Madsen (frbah@kt.dtu.dk), Anders E. Daugaard, Søren Hvilsted and Anne Ladegaard Skov

Danish Polymer Center, Department of Chemical and Biochemical Engineering, Technical University of Denmark, Building 227, 2800 Kgs. Lyngby, Denmark



Dielectric electro 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 a mechanical deformation is induced. DEAPs are normally constructed from thin filled elastomer films sandwiched between two compliant electrodes.<sup>1</sup>

Polydimethylsiloxane (PDMS) is one of the most used materials for DEAP applications due to its good thermal stability, high efficiency and fast response.<sup>2</sup> To obtain high actuation strain of DEAPs, the activation voltage is in general too high for many practical applications. One method to lower the activation voltage is to increase the dielectric permittivity of the elastomer film. The aim of this work is to increase the dielectric permittivity by creating new functional PDMS networks. This is done by the design of a novel silicone compatible cross-linker that allows for orthogonal chemistry and contains both vinyl groups for cross-linking reactions with hydride-terminated PDMS and an azide functionality that opens up for click reactions. In this case, the copper-catalyzed cycloaddition of an azide group and an alkyne (CuAAC) forming a 1,4-disubstituted-1,2,3-triazole.<sup>3,4</sup> In this way, functionality such as dipole molecules can be incorporated into the PDMS network at the cross-linking point in a controlled and well distributed way (Figure 1). Even very small loadings (<1 wt %) of incorporated dipoles have led to a large increase in the dielectric permittivity.

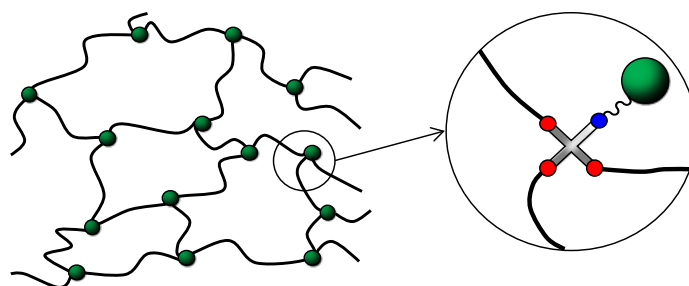


Figure 1: PDMS network with incorporated functionality at the cross-linking point.

## References

- (1) Pelrine, R.; Kornbluh, R.; Pei, Q.; Joseph, J. *Science* **2000**, *287*, 836–9.
- (2) Brochu, P.; Pei, Q. *Macromolecular rapid communications* **2010**, *31*, 10–36.
- (3) Meldal, M. *Macromolecular Rapid Communications* **2008**, *29*, 1016–1051.
- (4) Binder, W. H.; Sachsenhofer, R. *Macromolecular Rapid Communications* **2008**, *29*, 952–981.