# Side-group modified high permittivity silicone elastomers for dielectric elastomer actuators

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The technology of dielectric elastomer actuators requires materials with excellent elastic properties and high dielectric permittivity. Commercially available silicone elastomers (*e.g.* PDMS) show excellent elastic and dielectric properties but suffer from a low permittivity. We synthesized high permittivity silicone based elastomers which are a promising alternative to PDMS. They are prepared *via* post-polymerization modification of a high molecular weight polymethylvinylsiloxane using thiol-ene click chemistry leading to thioether and cyano-functionalized polymers. Thin elastic films were prepared by either using tin catalyzed condensation reactions with alkoxysilanes as cross-linker or photoinduced thiol-ene click reaction, respectively. Both approaches allowed preparation of silicones with well-balanced dielectric and mechanical properties. The thickness of the silicone films can be tuned from 100 microm to 20 microm using doctor blade techniques. Actuators show lateral actuation strains of more than 25% at an electric field of 24 V/microm and reached lifetimes of over 50.000 cycles (2Hz). The impact of thioether and cyano side groups on the elastic modulus and viscoelasticity, permittivity, conductivity, dielectric breakdown and actuation strain of the silicone films will be presented in detail.

[1] S. J. Duenki, Y. S. Ko, F. A. Nueesch, D. M. Opris, *Adv. Funct. Mater.*, **2015**, *25*, 2467–2475
[2] P. Caspari, F. A. Nueesch, A. Neels, D. M. Opris, *RSC Adv.*, **2016**, *6*, 98059-98065