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Silicone based bimodal networks applicable as electroactive systems

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The dielectric elastomers (DE) are part of the electronic electroactive polymers (EAPs) and present a good combination of electromechanical properties such as high achievable strains and stresses, fast response speeds, long lifetime, high reliability and high efficiency. A polymer network is a three-dimensional entity formed by the interconnection of polymer chains and is sometimes referred to as an elastomer. In the present paper elastomeric bimodal networks are synthesized using two different molecular weight vinyl-terminated polydimethyl siloxanes (short PDMS chains and long PDMS chains), a 4-functional crosslinker and a platinum-catalyst. The bimodal networks are prepared using a 'two-step four-pot' mixing procedure. The pre-premixes A contain PDMS and crosslinker, while the pre-premixes B contain PDMS and catalyst. Films with a thickness of 100 µm are prepared using an in-house constructed coating device. The viscoelastic behaviour as function of the applied frequency (LVE diagram) is shown for different systems with varying stoichiometric values and the short chain:long chain mass ratio. The macromolecular structure of the new silicone networks is a controlled alternance between strength and flexibility/elasticity. The final networks are characterized by a low viscous dissipation and a low elastic modulus. The systems have promising properties for DEAP purposes as they are highly extendible, with a fast response, and have great stability and hence postpone the rupture.

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