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***EuroEAP – 7th international conference on Electromechanically Active Polymer (EAP)
transducers & artificial muscles***

***Insight into the thermal degradation behaviour and
degradation products of cross-linked polydimethylsiloxanes***

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Silicone elastomers are extensively used for electromechanical applications such as dielectric elastomers transducers, due to their unique features[1]. In particular, thermal stability is fundamental with respect to the reliability and the performance of silicone-based devices. This remarkable resistance to high temperatures is due to the high bond dissociation energy of the siloxane bond and the pronounced flexibility of the chain backbone. Keeping in mind the vast majority of work done so far on the degradation of silicones[2,3], the goal of this study is to achieve a deeper insight into the thermal degradation mechanism of commercial silicone elastomers with the main aim of translating it into the complex, coupled thermal and electrical breakdown processes that dielectric elastomers undergo. A systematic analysis of the thermal behavior was carried out using thermogravimetric analysis (TGA) performed in inert atmosphere (pure thermal degradation) on cross-linked PDMS networks. Extraction of the samples in heptane was exploited in order to remove the non-bonded PDMS chains and determine to which extent the thermal degradation is influenced compared to the pristine elastomers. This study is to be used in a design guide towards reliable and robust dielectric elastomers.

[1] F. B. Madsen *et al.*, "The current state of silicone-based dielectric elastomers transducers", *Macromol. Rapid Commun.* **2016**
DOI: 10.1002/marc.201500576.

[2] G. Camino *et al.*, "Polydimethylsiloxane thermal degradation Part. 1 Kinetic aspects", *Polymer* **42** (2001) 2395-2402.

[3] G. Camino *et al.*, "Polydimethylsiloxane thermal degradation Part.2 The degradation mechanism", *Polymer* **43** (2002) 2011-2015.