Electrical breakdown phenomena of dielectric elastomers

Yu, Liyun; Mateiu, Ramona Valentina; Skov, Anne Ladegaard

Publication date:
2017

Document Version
Peer reviewed version

Citation (APA):

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.
2.3.19 Electrical breakdown phenomena of dielectric elastomers

Liyun Yu, Ramona Valentina Mateiu, Anne Ladegaard Skov*
Technical University of Denmark, The Danish Polymer Centre
al@kt.dtu.dk

Figure 1. Electrical **breakdown** causes a **pinhole** formation on DEs film leading to major damage of the DE based devices.

Figure 2. The structure of **chloro propyl** functional silicone elastomer.[1]

Figure 5. Illustration of boiling nature of the crosslinked copolymer Co-1 in different magnifications. Droplets of condensing degradation products are formed on the surface of the breakdown zone.

Figure 4. SEM images of breakdown zones for reference samples, Co-1 and Co-2 silicone elastomers. The black areas correspond to areas where the elastomer was completely removed during breakdown, i.e. pinholes.

Breakdown zones vary dimensionally with narrowest width to largest width:
- Reference: 100-300 µm
- Co-1: 60-100 µm
- Co-2: 20-80 µm
Energy Dispersive X-Ray Spectroscopy (EDS) - Elemental Distribution

**Figure 6.** EDS mapping of Co-2 elastomer surface where Cl is uniformly distributed (left), breakdown zones for Co-1 (middle) and Co-2 (right). The material in the vicinity of the void contains excess of Cl (blue color), which support the hypothesis that silicon-containing substances have been evaporated off.

**Figure 7.** An increased concentration of Cl is recorded at the breakdown zones for the crosslinked copolymer Co-1.