Electrical breakdown phenomena of dielectric elastomers

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

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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]

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Scanning Electron Microscope (SEM) - Morphology

**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

**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.

60 µm
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.