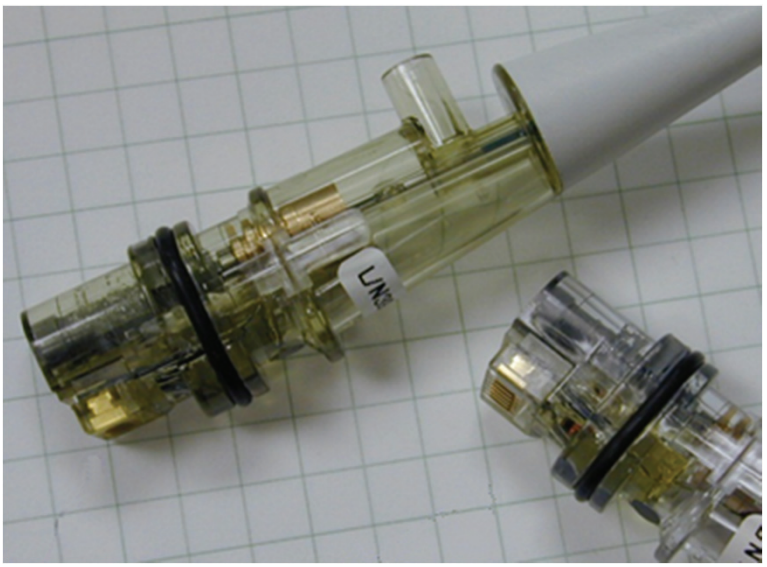
Failure analysis in catheters

Summary

A client presented catheter hubs that appeared to be cracking during their manufacturing process. The hubs were compound structures with polycarbonate embedding electronics and the catheter itself. A detailed understanding the interaction between the materials and the processes in use was vital to allow determination of the cause of failure. Cambridge Polymer Group isolated the root-cause and proposed an alternative manufacturing strategy that the client adopted.

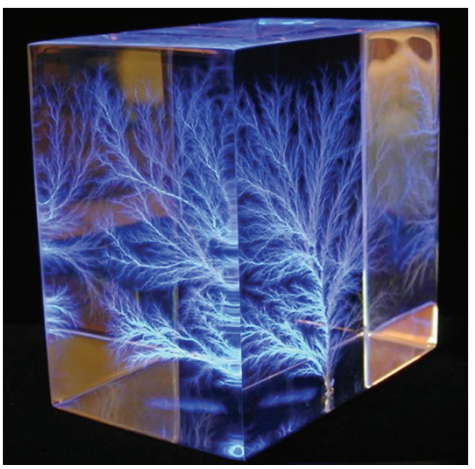


Description

The client was utilizing proven sterilization technologies to provide terminal sterilization of their components. E-beam sterilization is routinely used in the biomedical industry but has a severe drawback in some materials. The high flux and beam energies cause rapid charge build up on components. If uncompensated, this charge can arc between the charged surface and metal contacts resulting in fracture of the insulating polymer. CPG determined this process as the root-cause of the issues and devised an alternative sterilization strategy utilizing the gamma radiation process allowing the client to meet their process requirements with virtually no other changes.

Analysis

The spectacular dendritic discharge patterns formed in a dielectric by electrical discharge are known as “Lichtenberg figures” and result from breakdown of the polymer dielectric when excessive charge is built up during the high-flux electron beam radiation process. This process is analogous to the discharge that occurs during a lightning storm and can cause catastrophic failure of components if not adequately controlled. Lower energy, or non-irradiative sterilization circumvents this issue.



Key points

- Routine processes can cause unexpected issues
- Understanding materials and processing conditions is vital
- Interdisciplinary approach critical for modern systems and products

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ISO 9001:2008 Certified

Rev: 06/03/11