Cambridge Polymer Group

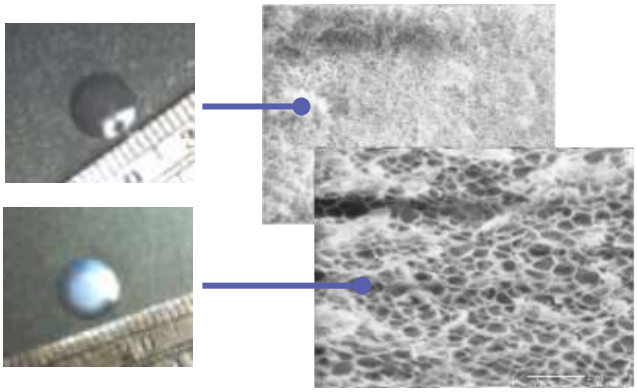
Artificial Lens Hazing Root-Cause Analysis

Summary

Intraocular lenses (IOL) are often implanted as a replacement for cataract-damaged lenses, or in some cases to change the optical power of the lens. These lenses were originally made from poly(methyl methacrylate) (PMMA) but are now often silicone and acrylic. The ideal material for this application is one that has a sufficiently high optical power (refractive index) but is soft and pliable allowing a minimal incision (and biocompatible). A client of Cambridge Polymer Group came to us with concerns over hazing that was occurring in a new formulation of lenses during manufacture.

Description

Frequently, traditional IOL's were not designed to be hydrated in use and were composed of impermeable materials such as PMMA and silicone rubbers. However, later versions are increasingly attempting to develop hydrophilic materials that are more relevant for the human body. Conventional polymerization processes are in general random and poorly controlled resulting in microstructures that can often lead to non-ideal optical properties. If the underlying polymers are too "blocky" they will tend to phase separate in larger domains that can readily scatter light, rendering the lens opaque and useless.



Cambridge Polymer Group performed root-cause analysis on samples provided by the client. Through an extensive and complex testing procedure staining, drying, deformation and direct microstructure visualization using SEM, the cause of the cloudiness was traced to a poorly controlled reaction process resulting in microcavitation within the lens during the swelling process as the lens hydrated.

Key Points

- Hydrogels are complex, multi-phase materials that are require physics and materials science as well as chemical experience to fully understand
- Understanding the underlying chemistry of the process, as well as the basic physics involved is critical to solving many interdisciplinary problems
- Complex problems are rarely solved without a range of analytical tools, the skills to use them effectively and the experience to integrate the disparate information in a useful manner

Cambridge Polymer Group, Inc. is a contract research laboratory specializing in materials. We partner with our clients to solve the world's toughest polymer problems utilizing our multi-disciplinary research team and full service laboratory.

We work with clients throughout the product life cycle to:

- Develop new materials
- Design prototypes for proof-of-concept studies
- Create and execute experimental design
- Validate and verify manufacturing processes
- Perform root-cause analysis in product failures

Cambridge Polymer Group, Inc. was founded in 1996 to provide a cost-effective resource for testing, research and development to clients who need periodic access to Ph.D.-level scientists and their support structure. We have developed a host of testing methods and materials for our clients, which number more than 1,000.

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