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Title: CR-39® and its influence on the ophthalmic industry over the past 60 years
From: Dick Whitney

If at first you don't succeed, try 39 times and you may hit the jackpot! So begins the story of how CR-39, the most successful and influential plastic material for ophthalmic lenses was born.

During WWII the Columbia Southern Chemical Co. (later a part of PPG), was looking for a plastic material that would be a suitable substitute for window glass. They tried approximately 200 experimental polymers, and their 39th attempt proved to be an astounding success – but not for window glass. **C**olumbia **R**esin's **39**th formulation was the material we commonly refer to as CR-39®. The chemical name for CR-39® is allyl-diglycol carbonate, and is a thermosetting plastic which must be cast, not molded.

The properties of CR-39® are unique, and ideally suited for ophthalmic lens applications. There are a wide variety of reasons why 60 years after its introduction, this material still comprises nearly 50% of the lens market in volume. CR-39® was also primarily responsible for the decline in glass sales, a trend which first began in the 1970s. There are many features of this material that make it most suitable as an ophthalmic lens plastic. Its unique optical properties (balance of index and Abbe values), clarity, density (1/2 that of glass), tint-ablity, ease of processing are attributes that have contributed to making it the most successful plastic material in the history of ophthalmic lenses.

The inherent abrasion resistance of CR-39, compared to most other optical plastics, has demonstrated that even without abrasion resistant coatings it is acceptable in the marketplace for this feature. All common abrasion test methods in use today use CR-39 as a benchmark for which other material /coatings must meet or exceed.

The impact resistance of CR-39® is also a factor in its success in markets like the United States. Unlike glass which must be treated to be strengthened for impact resistance compliance to the FDA dropball test, CR-39® does not require such treatment. For this reason, batch testing of product, rather than 100% testing was permitted by the FDA for meeting their regulation.

Finally, perhaps the most overlooked benefit to the widespread use of CR-39® has been the development of the casting process itself. Since CR-39® lenses are cast by using front and back molds (generally made from glass) with a supporting gasket, new configurations in lens designs were made practical for volume manufacturing applications. An early benefit to the casting process was the placement of the toric (cylinder) surface on the back surface of the lens nearer the eye. This has optical benefit, but was not practical when glass product was commonly used. Toric surfaces were more easily applied to the front surface, which is why glass products were plus toric in their configuration. But with glass molds, minus toric's could now be transferred from the back glass mold to the lens. With the advent of CR-39®, minus toric lenses now became commonplace. Furthermore, progressive 'no-line' bifocal lens surfaces were made easier to fabricate in large quantities, as one progressive mold could produce hundreds of lenses.

In summary, the birth of CR-39® has been the most influential and successful plastic material in the history of ophthalmic lenses. While other materials may one day surpass CR-39® in its usage, it is hard to imagine that it will ever be more a influential material to the industry.