11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Ophthalmic Lenses Produced by Photopolymerization: Evaluation of Defects and Hardness

M. E. D. Altidis [(1)]*, C. R. S. Morais [(1)], B. S. Lira [(2)] and S. A. Morais [(3)]

(1) Universidade Federal de Campina Grande, Departamento de Engenharia de Materiais, Campina Grande – PB, Brazil, e-mail: marinaaltidis@yahoo.com.br
(2) Universidade Federal de Campina Grande, Departamento de Engenharia Civil.
(3) Universidade Estadual da Paraíba, Departamento de Química.

Abstract – The monomers photopolymerization has been receiving special attention in the development of new materials to ophthalmologic purposes considering industrial, technological and scientific aspects, in substitution of the conventional processes which use organic peroxides as thermoinitiators to the polymerization. These processes present large cure cycles (around 20 hours), while the polymerization through the photoinitiation processes reaches a faster cure (around 7 minutes) representing economies of time and energetic resources. The objective of this work is to study and evaluate the structural properties (defects), mechanical (hardness) and the coloration of the lenses produced by photopolymerization.

The photoinitiation by ultraviolet allows a faster polymerization and reduces the exothermic effects of the reaction, in addition to providing the manufacture of superior quality lenses than the ones obtained by the traditional process. [1]. These polymerization systems have as basic components in their formulations: Monomer, Oligomer and photoinitiator. Generally the monomers have low molar extinction coefficient therefore it is necessary to add to the formulation a photoinitiator that absorbs light and produces the reactive, radical or ions species which begins the polymerization [2].

For the achievement of this study it was used a mixture of photopolymerization organic compounds that were injected inside the set of molds (mold, countermold and small box), with the aid of a syringe and an amount of mass around 40 mg. Then the set of molds were inserted into a photopolymerization equipment, with the time being controlled between 0,5 and 1,2 minutes, to obtain the ophthalmic lenses. After being photopolymerized, the semi-finished lenses were withdrawn from the set of molds. These showed a salmon coloration and a small amount of defects.

The produced ophthalmic lenses were submitted to tests of hardness, with the use of a Barcol Impressor, this method evaluates the hardness of a material through the measure of penetration resistance of a steel tip forced by a spring. In the measurement instrument, called Barcol Impressor, there is a scale of 0 to 100. The experiment is standardized by ASTM D2583 (Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor).

Analyzing the hardness of the produced lenses, it was observed that it ranged between 80 and 85 (table 1). The hardness value acceptable for this type of material is over 75. Therefore, the produced lenses presented the appropriate hardness for use.

Table 1: Hardness variation according to the time of cure.

Time of cure (min.)	Hardness(Barcol)
0,58	80
0,70	83
0,77	80
0,97	83
1,16	85

References

[1] F. M. S Brogna and S. P. Ravagnani, Modelagem e simulação da polimerização termo e foto-iniciada de resinas di-carbonato di-alila de etileno glicol para a Produção de Lentes Oftálmicas. Polímeros: Ciências e Tecnologia, São Carlos, BR, v.12, n. 4, p. 265-272, 2002.
[2] M. E. D. Altidis, C. R.S. Morais, A. S.Leal, S. O. Ramos, M. S. L. Cavalcanti, D. C. Araújo, Characterization of Photoiniciator for Applying in Photopolymerization Reaction to Produce Ophthalmic Lens, in Anais do 14th ICTAC – International Congress on Thermal Analysis and Calorimetry, 2008.