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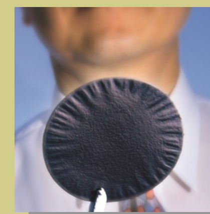
Technology Opportunity



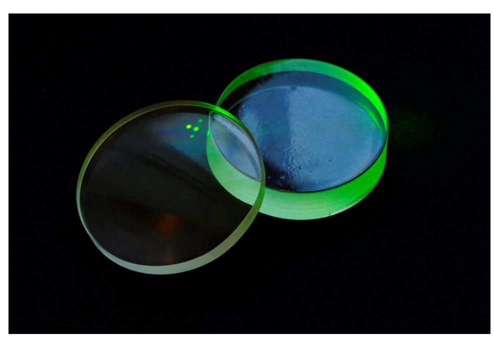




New High-Refractive Index Polymers: Solutions for Next Generation Eyewear, Optical Adhesives and Microarray Lens Technology

Organic polymers play a key role in a number of important optical applications. Principle among them are as lens materials for consumer eye-wear where their unique combination of high refractive index and optical transmission combined with scratch and fracture resistance have lead to the safe light-weight corrective lenses that are used today. In addition, they are critical in a number of specialized advanced technological applications such as microlens arrays for CCD sensors and encapsulates for light emitting diodes.

Dr. Albert Stiegman has developed a new class of low-density, high refractive index polymers that have optical and mechanical properties that recommend them for a number of current and future optical applications. The polymers are hybrid organic-inorganic materials, the constituents of which contain highly polarizable atoms and groups that contribute to the high refractive indices and excellent optical transparency observed for specific compositions. They can be formed into hard monolithic structures that can be ground and polished to obtain lenses and other optical components. Synthesis of the polymers is technologically simple and from easily obtained components suggesting that their manufacture will be cost effective. Potential applications include eyewear and other consumer optical products such as camera, magnifying glasses and telescopes. In addition, the polymers have excellent adhesive properties that may find application as index-matched adhesives in optical assemblies.



Applications

- Consumer eyewear and optics.
- Microlens array technology.
- Encapsulates.
- Optical Adhesives.

Unique Advantages

- This polymerization method is less expensive and more efficient than current methods.
- Produces a lighter, thinner, and stronger material than is currently available on the market.
- May be fabricated with enhanced flexibility for use in medical procedures such as the surgical insertion of intraocular lenses and the use of flexible light guides.

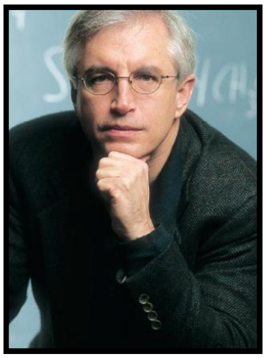
Technology Opportunity

Status

- Provisional patent application filed: U.S. 61/237,897.
- Prototype developed.
- Samples of the transparent material, as large as 2 inches in diameter, have been synthesized.
- Refractive indices of the material have been measured as high as 1.74, and this value is expected to reach 1.8 as the product is refined.
- Samples of the material were successfully ground and polished into prototype optical flats using commercial lens-making equipment.

Current Work Underway

- Continue refinements to the development of the high refractive index polymer.
- Develop these materials as index matched adhesives for use in composite optics applications.
- Large scale prototype development.
- Adhesion studies.
- Composite lens fabrication.



Areas of Research

Dr. Stiegman's group is principally interested in exploring the interface between traditional inorganic chemistry and materials science. To this end, techniques for studying the reactivity, structure, and bonding of inorganic complexes, which have their roots in traditional inorganic chemistry, are applied to important classes of inorganic materials. From the understanding gleaned from such studies, new and potentially useful materials can ultimately be engineered. Particular classes of materials that are both technologically important and amenable to study by their approach are glasses derived from the sol-gel process. This process utilizes the condensation reactions of silicon or metal alkoxides to afford a low-temperature, synthetically flexible route to inorganic glasses and ceramics. For the synthesis of a silicate glass, for example, tetramethylorthosilicate is simply treated with water, which causes it to gel. The gelled materials are then aged and dried, producing a material known as a "xerogel." Xerogels are hard and optically transparent much like conventional silicate glass; however, they are also highly porous, allowing small molecules to permeate them. By exploiting the synthetic flexibility of the sol-gel process, his group has succeeded in incorporating a broad range of transition metal centers into the silica matrix.

The resultant material has remarkable properties that are a hybrid of the chemical reactivity of the transition metal center and the structural and morphological properties of the silica matrix. For example they undergo a variety of both thermal and photochemical reactions depending on the metal center present. Dr. Stiegman's studies of these hybrid materials have focused on their controlled synthesis and on their characterization utilizing electronic, vibrational, and magnetic resonance spectroscopic techniques.

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