Composite Sol-gel Hybrid Optical Coating for Infrared (IR) Applications

Advantages

• Low cost, room temperature method that makes use of the unique properties of sol-gel to dramatically enhance the transmission of chalcogenide glasses by lowering reflection over a broad range of light wavelengths.
• Coatings are very mechanically sound and simple to create with minimal defects
• Cost effective sol-gel solution is easy to prepare from commercially available chemicals
• Anti-reflective sol-gel coating create a protective layer on the surface that is resistant to abrasion

Invention


Background

For many years, antireflective coatings have been successfully created from sol-gel derived thin films. In recent years, chalcogenide glass has emerged as a useful material in applications such as optical switching, and biomedical and thermal imaging. Chalcogenide glasses are of great interest due to their semiconducting properties, transmission throughout the infrared region and their non-linear refractive index. Further, such materials have high chemical stability. Common applications of this unique glass substance include night vision systems and thermal imaging. Both applications exploit the excellent transmission of the chalcogenide glass throughout the infrared region of light. However, in order to utilize this transmission to its fullest extent, it is essential to enhance the property through the addition of antireflective (AR) coatings. When light passes through a medium it is bent, thereby traveling slower. This change in speed which light encounters can cause reflection. With chalcogenic glass, the light is bent significantly, which can result in significant transmission losses. Prior art methods for AR coatings of chalcogenide glasses are both complex and costly. Therefore, there is a need for cost effective AR coatings that will increase transmission for enhanced efficiency and lower reflection.

The novel optical AR coating developed by UCF engineers can be used on chalcogenic glass. It has proven to be an excellent means of improving the efficiency of the material for infrared (IR) applications. In addition, this new hybrid sol-gel coating is much cheaper to apply as it can be done by both spin coating and dip coating methods. By using one of these two methods there is no need for heat to be applied, vacuum to be used, or expensive specialized equipment to be purchased. The sol-gel coating increases transmission, lowering reflection over a broad range of light wavelengths, also creating a protective layer on the surface that is resistant to abrasion. With this new solution it is possible to harness the power of sol-gel, while still abiding by the rules of AR coatings. The creation of this coating is an important step forward and should prove to be of future interest as the applications of chalcogenide are fully realized.

Application

This novel process can be used to increase optical transmission in a wide range of applications that operate in the infrared range. It can be utilized in lighting systems, laser technology, projection systems, medical applications, band-pass filters for information technology and coatings for displays. Any manufacture of products which suffer from infrared reflection could utilize this process to significantly increase the capabilities of their products, without greatly increasing their price.

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Selected References