Abstract

The design of a variable focal length, or flexi-focus, polydimethylsiloxane (PDMS) lens incorporating a light emitting diode (LED) source is intended for future use on board commercial aircraft. Specifically, the design is intended for the Boeing 787 Dreamliner aircraft, serving as a personal reading light for the passengers seated in the cabin. Most current reading lights on board aircraft are rigid, incandescent, and have very limited freedom in terms of adjusting the emitted light. Incandescent lamps are also inefficient with respect to energy consumption and light output as well as a high heat output. In an economy of increasing demand for cost efficiency, environmentally friendly solutions, and user friendly devices, this lighting configuration is a hindrance in its application. The Flexi-Focus LED light system will remedy this problem by allowing the passenger the freedom to refocus the light from broad flood lighting to precise spot lighting, adequate for reading. A table of user needs can be seen in Table I of Appendix F. This system involves a variable-focal length lens fabricated with PDMS, incorporated with an LED, which has the ability to flex into a range of convex surfaces when the pressure in an airtight chamber behind it is increased, thus enabling optimization for a broad range of applications. The focal length of the lens is a function of the refractive index of the lens material and the radius of curvature created by the deflection. With a known refractive index for the material, the light can be made to focus at specific distances. In the application of interest for this project, this enables the area illuminated by the LED to vary.