The Flash Shade: Directional Darkening Technology

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It is always unpleasant and dangerous to be blinded by glaring light, whether from the setting sun or bright arc welding flashes. As conventional darkening methods provide an inadequate solution, the aim was to develop a new technology for smart sunglasses. This technology would automatically and selectively darken only bright light sources so that the wearer receives a view in which all incident light rays are homogenously adjusted to a pleasant brightness. This was achieved through an intricate combination of semi-transparent organic solar cells and liquid crystal shutters, for which the respective characteristic curves (i.e. luminance, transmission, and voltage) were analyzed in a self-made solar simulator. The most promising substances for a symbiotic combination were identified amongst multiple electrochromic and photoelectric materials. These were integrated into a specifically designed honey-comb like structure, that imperceptibly sectorizes the wearer's view. A CAD program was used to rapid-prototype the design. The functionality was then proven on a large-scale prototype. A strong degree of darkening was observed for outdoor luminance (1400lx-7000lx, Transmission: 0.46%), a medium degree for 150lx-1400lx (Transmission: 2.47%) and a minor degree for indoor luminance (0lx-150lx, Transmission: 13.8%). The determined reaction speed was at ~67ms (the eyelid closure reflex requires 250ms). The results clearly show a luminance controlled darkening effect. A microcontroller could deliberately be omitted for the appliance to be mobile and lightweight. The fast reaction speed further proves its importance for light intense conditions (ie. welding or laser safety). This solution is, therefore, a viable option to existing sunglass technologies.

Awards Won:
Dudley R. Herschbach SIYSS Award
Raytheon Technologies Corporation: Each winning project will receive $3,000 in shares of UTC common stock.
China Association for Science and Technology (CAST): Award of $1,200