Sensitive Sunglasses

Oxidation – reduction reactions are the basis for many interesting and useful applications in technology. One such application is photochromic glass, which is used for the lenses in light – sensitive glasses. Lenses can change from transmitting 85 % of light to only 22 % of light when exposed to bright sunlight.

Photochromic glass is composed of linked tetrahedrons of silicon and oxygen atoms jumbled together in a disorderly array, with crystals of silver chloride caught in between the silica tetrahedrons. When the glass is clear, the visible light passes right through the molecules. The glass absorbs ultraviolet light, however, and this energy triggers an oxidation – reduction reaction between Ag^+ and Cl^-.

$$Ag^+ + Cl^- \xrightarrow{\text{UV light}} Ag^0 + Cl^0$$

To prevent the reaction from reversing itself immediately, a few ions of Cu^+ are incorporated into the silver chloride crystals. These Cu^+ ions react with the newly formed chlorine atoms:

$$Cu^+ + Cl^0 \rightarrow Cu^{2+} + Cl^-$$

The silver atoms move to the surface of the crystal and form small colloidal clusters of silver metal. This metallic silver absorbs visible light, making the lens appear dark (coloured).

As the glass is removed from the light, the Cu^{2+} ions slowly move to the surface of the crystal where they interact with the silver metal.

$$Cu^{2+} + Ag^0 \rightarrow Cu^+ + Ag^+$$

The glass clears as the silver ions rejoin chloride ions in the crystals.

na podstawie podręcznika *"**Introduction to General, Organic, and Biochemistry**", 6th edition, autorzy: Morris Hein, Leo R. Best, Scott Pattison, Susan Arena* opracował Wojciech Kin