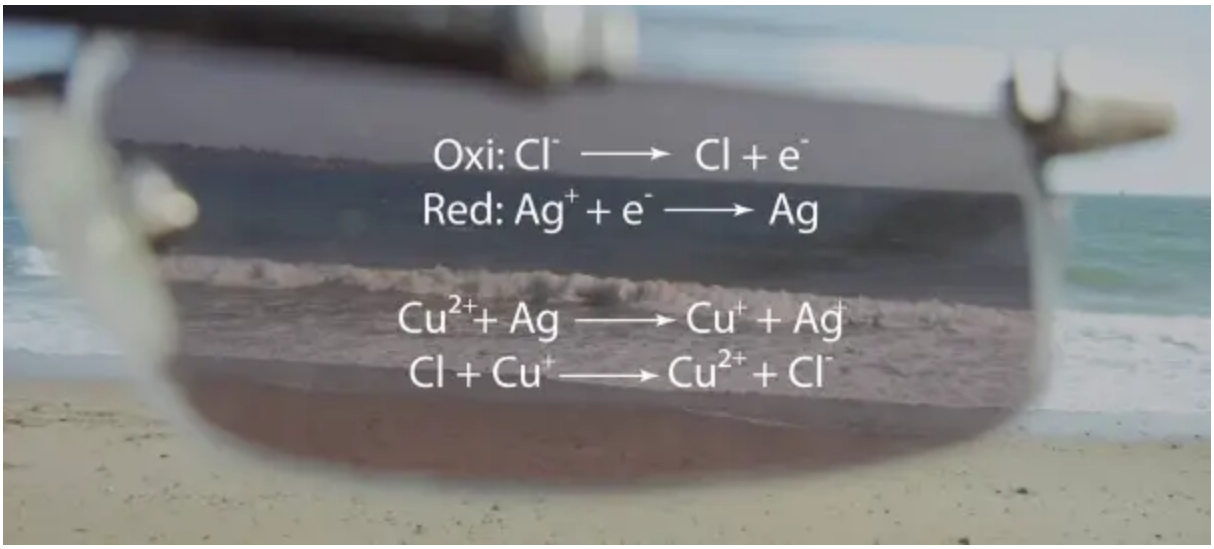
BogDog Sunglasses



Photochromic lenses

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Chlorine atoms are reduced → no chlorine gas escapes

Copper I ions are oxidized to form Copper II ions.

In photochromic lenses, AgCl and CuCl (Copper I) crystals are added while the glass is in molten state. This allows the crystals to be embedded evenly throughout the glass as it changes back to solid state.

A physical property of AgCl is its relative ease in undergoing redox reactions under a light source. (specifically a UV light source → higher energy)

In the reaction, chlorine ions are oxidized (lose their electron) whereas the silver ions reduce and gain an electron. This causes the silver ions to convert into solid silver atoms. It is this reaction that darkens the lenses. Darkening is dependant on the intensity of light. UV light would darken it the most/ the most reactions would occur because, having the shortest wave length and highest frequency, it has the most energy out of all the wavelengths.

But wait… You cannot ignore the CuCl crystals which was also placed in the glass.

What do these do you ask?

According to the reduction series Chlorine is more likely to be reduced and Copper is more likely to be oxidized. When the lenses are removed from light the above reactions occur.

The copper II ions are then reduced by the solid silver ions. Reducing the solid silver that is present and returning the glass to its original state.

As shown in the table, Silver is higher up than copper (II) in reduction potentials and will act as an oxidizing agent in the redox reaction with copper (II).

One could also relate this to the concepts of le chataliers principle and equilibrium. Given the extra energy added to the system via the light, the system tries to compensate by splitting the AgCl compound. (the forward reaction is an exothermic reaction meaning that the reverse reaction is endothermic and requires heat) depending on how much energy is added, a matching portion of the Ag ions will form Ag solid.

Now these are for glass lenses. A lot of glasses are now plastic instead of glass. The problem with the glass ones was on prescription glasses where the glass did not have the same thickness throughout and thus the molecules were not uniformly distributed. (thicker parts would be darker than thinner areas)

For the plastic lenses, what they do is immerse the plastic lenses into a chemical bath with the molecules. This process turned out to be much more effective and turned the sunglasses darker when exposed to UV light because unlike the other way in which the molecules would only go on the glass surface 5 microns in, this way allowed the molecules to be embedded up to 150 microns into the plastic lens. This allows for a darker lens and is what is found what we know as Transition lenses. “Transition being a very popular brand of photochromic lenses”

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