COATED GLASS

This application is a continuation of application Ser. No. 07/529,748, filed May 25, 1990 is now abandoned which is a continuation of Ser. No. 06/762,844, filed Aug. 6, 1985 is now abandoned.

FIELD OF THE INVENTION

The invention relates to the production and use of glass with a surface coating which provides a barrier to the migration of alkali metal ions out of the glass surface, and to products incorporating such coated glass.

DESCRIPTION OF THE PRIOR ART

It is known that certain surface coatings on glass deteriorate as a result of migration of alkali metal ions out of the glass surface into the coating. For example, U.K. Patent Specification 705 934 describes the appearance of haze in a transparent electro-conductive coating on soda lime silica glass. The haze may be reduced by removing alkali metal ions from the glass surface before applying the electroconductive coating, or by applying an intermediate film, for example of silica or titanium oxide, before the electroconductive coating is applied. The silica films are prepared either by applying a solution of silicon tetrachloride or tetrabromide or of silicochloroform in a volatile non-aqueous solution, to the glass, and exposing to the atmosphere until the coating is dry and then rubbing until the coating is bright, or by dipping a glass sheet in a solution of a partially hydrolysed silica acid ester, for example ethyl ortho silicate, and drying.

European Patent Specification EP 0 071 865 A3 is similarly concerned with the deterioration of electroconductive coatings on soda lime silica glass as a result of alkali metal ions diffusing to the glass surface and interacting with overlying layers sensitive to alkali metal. It refers to white turbidity in the electroconductive layer, reduction in transparency, increase in electrical resistance and reduction in physicochemical durability as possible consequences of such diffusion. It also refers to the deterioration of liquid crystal display devices, electrochromic devices and amorphous silicon photovoltaic cells as a result of the diffusion of alkali metal ions from a glass substrate. Such devices generally include electroconductive layers, for example of indium tin oxide, on the glass, but EP 0 071 865 A3 refers to effects (additional to any direct effect of the alkali metal ions on the electroconductive layer) which result from interaction of the alkali metal ions with layers overlying the electroconductive layer.

EP 0 071 865 A3 proposes to prevent the diffusion of alkali metal ions from a glass substrate by use of a barrier layer of silicon oxide which contains hydrogen bonded to silicon. The barrier layer may be prepared by vacuum vapour deposition, sputtering, ion plating, sol/-gel methods or by CVD i.e. chemical vapour deposition. In the CVD methods described, silicon oxide layers are deposited on glass substrates under oxidising conditions at temperatures of from 300° C. to 550° C. from oxygen gas and monosilane gas (SiH_4) in ratios of O_2:SiH_4 of 10:1 to 60:1.

U.K. Patent Specification 2 031 756B discloses the use of layers of metal oxide, including silicon oxide, as colour damping layers to reduce the irridescent reflection colours exhibited by infra red reflecting coatings of semiconductor metal oxides on glass. The semiconductor metal oxide may be a fluorine doped tin oxide, and the specification refers to the known effect of amorphous silicon oxide layers in inhibiting diffusion of alkali metal ions from the glass thereby avoiding haze formation on subsequent deposition of an overlying tin oxide layer. The colour damping layers used in accordance with U.K. Patent Specification 2 031 756B preferably have a refractive index of 1.7 to 1.8 and are from 64 to 80 nm thick. Layers containing silicon oxide may be prepared by chemical vapour deposition on hot glass at 300° to 500° C. using silane in the presence of an oxidising gas.

U.K. Patent Specification 1 507 465 describes a process for applying a reflective coating of silicon to flat glass to provide a solar control glass with an aesthetically pleasing silver reflection colour. The coating is applied by releasing silane gas into a hot zone opening towards the glass surface, and maintaining non-oxidising conditions in the said hot zone, so that the silane pyrolyses depositing the reflecting silicon coating on the glass surface. U.K. Patent Specification 1 573 154 describes an improvement in the process of 1,507,465 for producing reflecting solar control glass; in the improved process, a gaseous electron donating compound, for example ethylene, is added to the silane containing gas and leads to an unexpected improvement in the resistance of the coated glass to attack by external alkali. The ratio of electron donating compound to silane is generally 0.1 to 2.0, and preferably 0.2 to 0.5, although the specification does refer to the use of a ratio greater than 2.5, for example 5, to produce an alkali resistant silicon coating with very good abrasion resistance but without the high reflectivity to visible light obtained in the absence of the electron donating compound. The coatings are applied to architectural glass, and the examples describe the application of the coatings to 6 mm soda lime silica float glass and to rolled glass. Coatings obtained using ethylene as the electron-donating compound were analysed and it was found that, although they were prepared under non-oxidising conditions, they contained some oxygen.

SUMMARY OF THE INVENTION

The applicant has found that thin transparent coatings produced in the presence of a high proportion of electron donating compound as described in U.K. Patent Specification 1 573 154 contain oxygen derived from the glass and are surprisingly effective as barriers to the migration of alkali metal ions from the glass surface. The resultant coated glasses are useful as substrates for overlying layers (whether lying directly on the barrier layer or over an intermediate layer) sensitive to alkali metal ions.

According to the present invention there is provided a method of reducing diffusion of alkali metal ions from a glass containing alkali metal ions into an overlying layer which method comprises providing between the glass and the overlying layer a transparent barrier coating containing silicon and oxygen applied by pyrolysis of a silane gas characterised in that the silane is pyrolysed on a glass surface above 600° C. in the presence of a gaseous electron donating compound whereby oxygen from the glass is incorporated with silicon to form a transparent barrier coating up to 50 nm thick on the glass surface.

The expression "transparent barrier coating" is used herein to refer to coatings which, when present on clear