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Modification of the glass surface by iso-thermal treatment under different gases

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In this paper we report a novel way to modify the glass surface in favor of some physical performances. The main step is to perform iso-thermal treatments on the selected silicate glasses containing transition metal at temperatures near the glass transition temperature for various durations under different gases. As a result, we have observed a striking phenomenon, i.e., the outward diffusion of divalent cations occurs not only under an oxidizing atmosphere of heat-treatment, but also under nitrogen, even under reducing atmospheres like H₂/N₂ (10/90). The extent of the cationic diffusion depends on temperature and duration of heat-treatments. The mechanism of the diffusion depends on the type of the gases used for the heat-treatments. In this paper we propose several possible models describing mechanisms of the cationic diffusion, and hence, of the formation of the nano-layer. We also report the effect of the nano-layer on properties of the glasses.