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What happens on the surface of basaltic glass fibers during heat treatment?

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Basaltic wool fibers (iron-rich aluminosilicate glasses) are used as heat and acoustic insulation material and fire barrier due to their excellent high temperature stability (HTS). We investigate the origins of the HTS of these glass fibers under different atmospheres. We show that the HTS is strongly related with diffusion processes that occur in the fiber surface layer during heat-treatment. The diffusion processes are in turn a result of the iron redox reactions under both oxidizing and reducing conditions. A modifier-rich MgO layer is created during thermal oxidation, whereas a modifier-depleted SiO₂ layer is created during thermal reduction. These layers have different influences on the crystallization behavior and chemical and mechanical properties of the fibers.