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Fictive temperature dependence of subcritical crack growth rate of normal glass and anomalous glass

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Abstract

Subcritical crack growth rates of soda–lime–silicate glass, which is a typical normal glass, and silica glass, which is a typical anomalous glass, with different fictive temperatures were measured by the double-cleavage-drilled-compression (DCDC) fracture mechanics technique under both dry and humid atmospheres in order to clarify the effect of the fictive temperature on mechanical strength and fatigue. In the humid atmosphere, the soda–lime–silicate glass with a higher fictive temperature showed a slower crack growth rate than the same glass with a lower fictive temperature while the silica glass with a higher fictive temperature showed a faster crack growth rate than the silica glass with a lower fictive temperature. These results imply that normal glass with a higher fictive temperature is expected to show a higher mechanical strength compared with the same glass with a lower fictive temperature and anomalous glass with a higher fictive temperature is expected to show a lower mechanical strength than the same glass with a lower fictive temperature when tested in ambient air if the flaw size is the same. In the dry atmosphere, the fictive temperature effects on the crack growth rate in both glasses were small and within the experimental error.

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