

ON THE PERSISTENCE OF METASTABLE CRYSTAL PHASES IN LITHIUM DISILICATE GLASS

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Abstract

The nucleation of metastable crystalline phases in glass is a topic of intense renewed interest. This issue is of considerable scientific importance due to observed discrepancies between theoretically predicted and experimentally determined nucleation rates in glasses. Of the few glass forming systems that appear to nucleate homogeneously, the lithium silicate system has been the most extensively studied glass forming system, and most observations of metastable phases in lithium silicate glasses have been reported for glasses close to the lithium disilicate composition. Although the formation of metastable phases in this system has been the subject of controversy for decades, recent results have spurred a reexamination of this topic. We investigate one aspect of this problem relating to the stability of these non-equilibrium phases when glasses are heated for extended time periods. Recently, we presented experimental evidence which indicated that metastable phases do not persist at long times. This finding is in direct contradiction to an earlier result, and we speculated that the discrepancy could have been the result of glass preparation procedure or glass composition. In this investigation, we examine these possibilities. Four different compositions of lithium silicate glass with compositions near the disilicate composition were studied. The glasses were prepared using different preparation procedures and were found to have various water contents. The glasses were heated for extended time periods at several different temperatures near the temperature of the maximum nucleation rate. Our results indicate that, regardless of composition or water content, metastable phases do not persist at long times. Further, we present the first measurements of nucleation and growth rates obtained via single-stage isothermal heating for temperatures near the maximum nucleation rate of these glasses.