The Effect of Hot-Compression on Silica Glass and its Optical Properties

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Silica glass is the most indispensable material for optical communications and high-power laser applications due to its excellent optical properties. The transmission loss of silica glass has been reduced over the past 30 years by continuous efforts toward decreasing density fluctuations by lowering of fictive temperature, e.g., through improvements in processing or doping. Our recent study has shown that shrinkage of structural voids (=empty spaces) by hot compression at 2000K is a promising way to further decrease the loss [1-3]. Other studies have shown that the structural fluctuation of silica glass is reduced when hot-compression is done at 1400K. However, hot-compression of silica glass tends to cause crystallization, particularly within the region where SiO_2 crystalline phase exist on the phase diagram, and/or it contains impurity, or the applied pressure is anisotropic. Thus, in this talk, I review our findings on pressure-quenching to reduce optical loss, including experimental and modelling results. Then the recent findings on the structure of the obtained hot-compressed glasses are introduced.

References

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Research Interests

Inorganic glass, nanostructure, optical, mechanical, and thermal properties