POTENTIALLY IMPROVED GLASSES FROM SPACE ENVIRONMENT

by

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Utilization of the space environment for processing glasses may prove to be advantageous based on the absence of gravity driven convection, lack of sedementation, and the benefits of containerless processing. Ground-based studies have been conducted where the potential of processing glasses has been evaluated for laser window, optical, lasing, and magneto-optical glasses. Present flight opportunities allow further investigation of these materials.

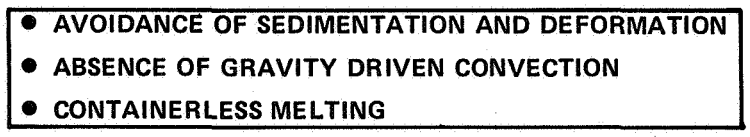

Figure 1. Advantages of processing glasses in low gravity environment.

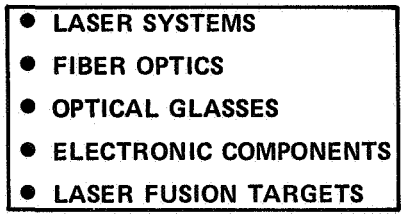

Figure 2. Potentially improved products.

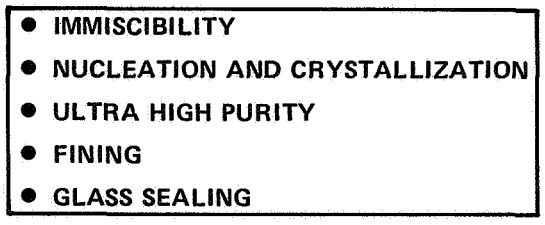

Figure 3. Phenomena to be explored.

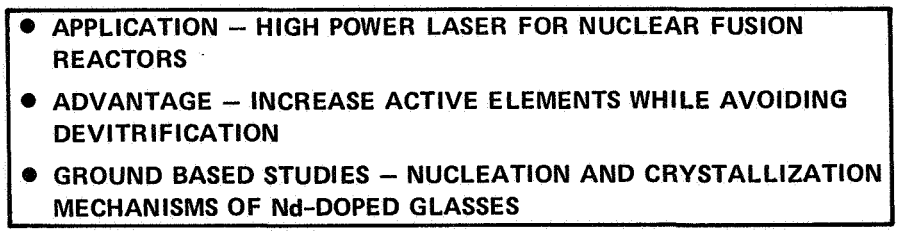

Figure 4. Space processing of laser glasses.

- APPLICATION – LASER WINDOWS AND IR FIBER OPTICS
- ADVANTAGE – ULTRA PURITY TO REDUCE ABSORPTION
- GROUND BASED STUDIES – OPTIMIZE TECHNIQUES TO IMPROVE TRANSMISSION PROPERTIES OF Ge_{28} Sb_{12} Se_{60} GLASS

Figure 5. Space processing of chalcogenide glasses.

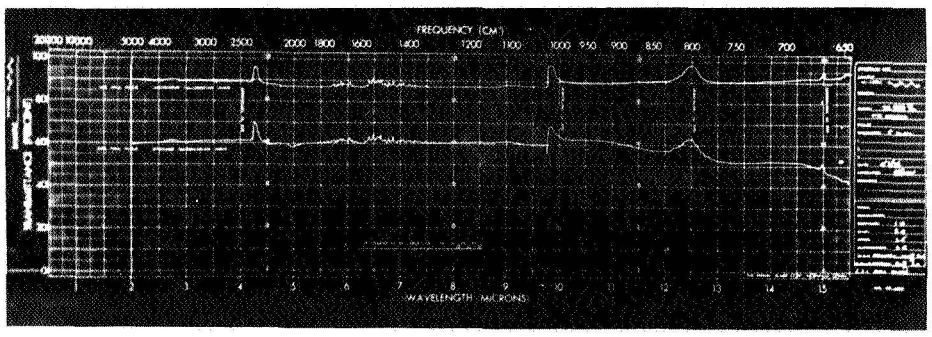

Figure 6. Transmission properties of chalcogenide glass.

- APPLICATION – MULTIELEMENT LENSES
- ADVANTAGE – EXTEND GLASS FORMATION REGION OF METAL OXIDES
- GROUND BASED STUDIES – AIR SUSPENSION CONTAINERLESS MELTING

Figure 7. Space processing of unique optical glasses.

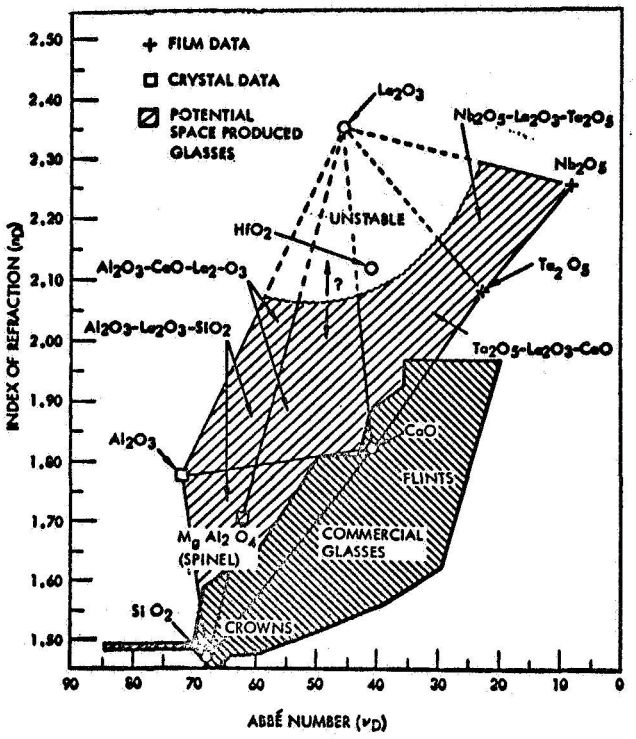

Figure 8. Optical properties of metal oxides.

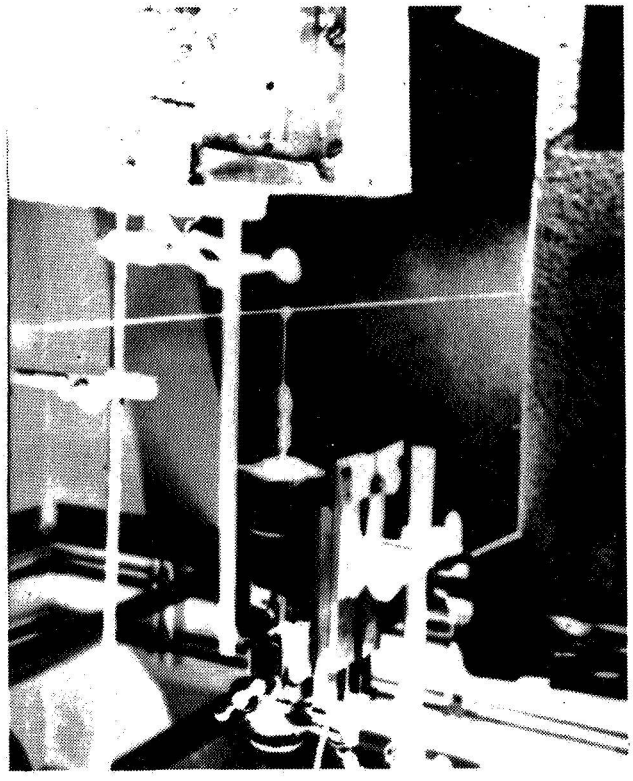

Figure 9. Laser melting device.

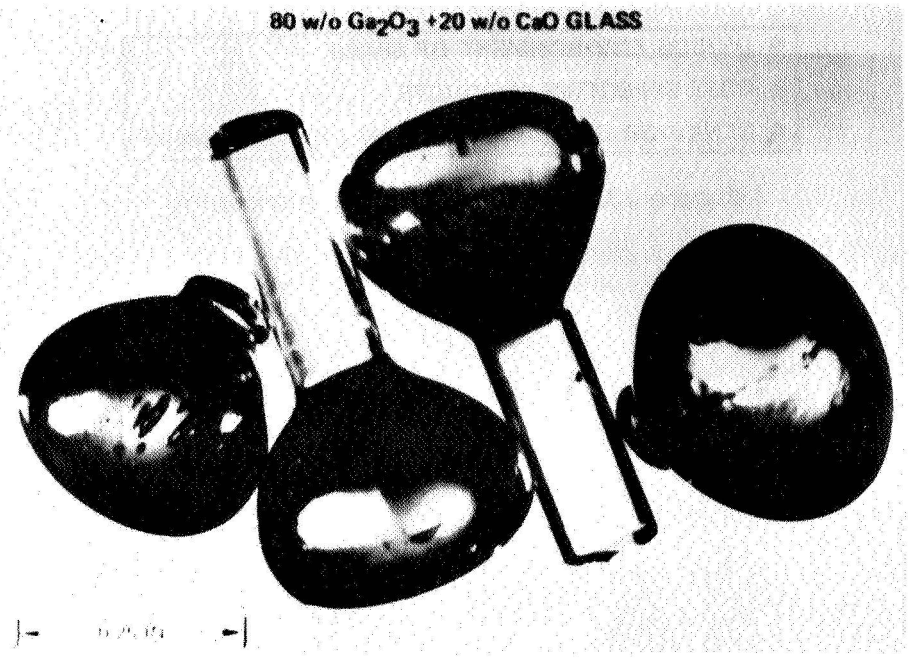

Figure 10. Glass boules produced by laser melting.

- APPLICATION – MAGNETO OPTICAL DEVICES
- ADVANTAGE – FORMATION OF GLASS-CERAMICS WITH HIGH CONTENT OF ACTIVE ELEMENTS
- GROUND BASED STUDIES – DETERMINE OPTIMUM MELTING CONDITIONS FOR OUTER SPACE

Figure 11. Space processing of glass-ceramics — overview.

- MATERIAL – IRON BORATE TRANSPARENT FERROMAGNETIC
- FARADAY ROTATION PROPERTIES
- REASONS FOR SPACE PROCESSING
  - GLASS WITH 17% Fe_2O_3 CANNOT BE PREPARED ON EARTH
  - ELIMINATION OF PHASE SEPARATION AND HETEROGENEOUS NUCLEATION
  - VALUE OF CONVERTING TO GLASS-CERAMIC

Figure 12. Space processing of glass-ceramics — objectives.

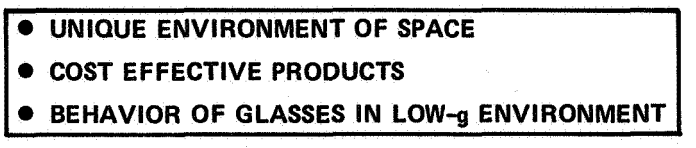

Figure 13. Glass processing summary.