Re-Investigating Phase Separation In Industrial Glasses And Their Associated Optical Properties

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ABSTRACT

Phase separation is a well-known phenomenon in glasses and has been the subject of intense investigations since the 70s of the last century. In the scope of the present work, we will be re-investigating dialogues from the 70s surrounding phase separation in glasses with modern state-of-the-art equipment and a focus on industrially relevant glass compositions. The key topics of this talk are the microstructure and the correlated optical properties of phase-separated glasses. Fig. 1 shows a stack of phase-separated glasses that can range from transparent, over blue and white opalescent to white opaque in their appearance. Depending on the size of the microstructure, this observation is explained by wavelength-selective Rayleigh scattering, which is also responsible for the characteristic blue appearance of our sky.

Figure 1. Silica Glass stack with changing scattering depending on the size of the microstructure. Average particle size increases from top to bottom.

For phase-separated glasses, it has been found that the Rayleigh approximation cannot adequately describe experimental observations. Therefore, the scattering equations are expanded by introducing a wavelength dependency factor p and a structure factor S [1]. Determining these introduced factors requires detailed empirical data about the microstructure of the studied glasses and to the best of our knowledge, this kind of data is rarely published. The current study aims to produce the necessary experimental data on a soda-lime glass composition for various heat treatments and employ the acquired data in different optical models. This way, we hope to gain deeper insights into the scattering character of phase-separated glasses and their applicability for wavelength-sensitive applications like UV-scattering glasses.

[1] N.S. Andreev, *Journal of Non-Crystalline Solids,* 30 (1978) 99-126.