Elevating Glass Industry with LIBS

Challenge

In today's glass industry, achieving high homogeneity of glass materials and precision in defect identification or concentration determination of various elements is critical. Traditional methods often involve lengthy and complicated procedures to analyze glass, require complex sample preparation such as grinding them to the defect point or dissolving them in chemicals, resulting in the process of measurement often taking several days. **Laser-Induced Breakdown Spectroscopy (LIBS)** however emerges as a promising solution that allows rapid and effective analysis of glass materials without the need for their destructive processing or long measuring time.

Solution

Identification of Excluded Phase

Analyzing the glass sample to identify its inhomogeneity with the **Sci-Trace LIBS instrument**, twelve elements with uneven distributions on the sample's edge and center were detected. A broader look at the spectra revealed not only uneven distribution of elements but also that specific elements (**F** and **S**) were present only in the center, further contributing to the identification of the contaminant's origin. These findings demonstrate **LIBS'** capability to detect material inhomogeneity and identify contamination.

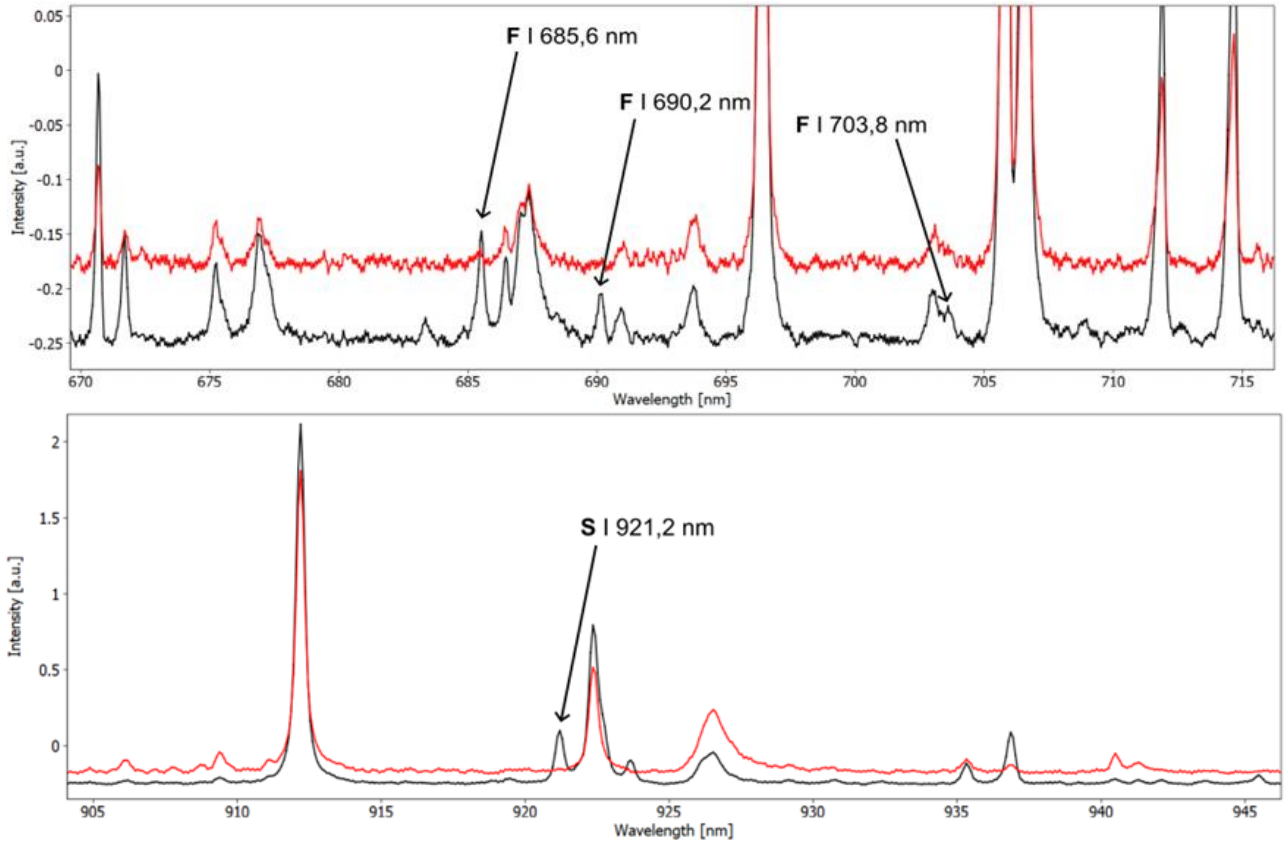

Figure 1: Distribution of F and S in sample's center (black line)

Defect Identification

In the case of analysis for defect identification, **LIBS** can effectively distinguish between glass composition and defects. Using an optical microscope, the defect's location was pinpointed, and multiple laser shots were directed at the defect site, resulting in identifying **Zr** as the base element of the defect from the furnace lining.

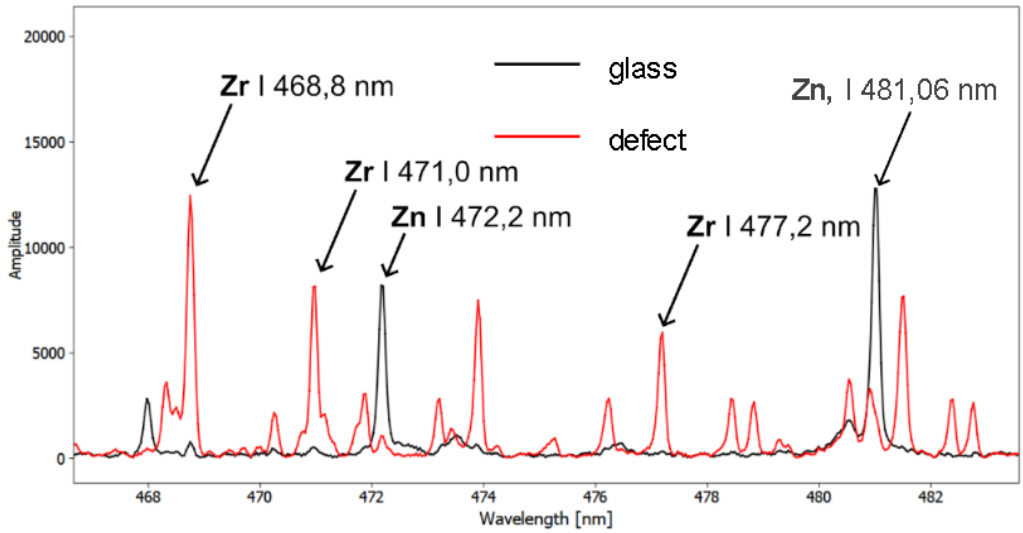

Figure: 2 Presence of Zr in a glass sample

Conclusion

LIBS proves to be an invaluable tool for the glass industry, enabling **fast, precise, and micro-invasive analysis** of glass materials as well as ceramics. This technology not only enhances production efficiency and material consistency but also facilitates quick and accurate defect identification, such as pinpointing undesired elements in glass stoppers. Its capability for **direct** and **minimal sample preparation** analysis stands out as a significant advantage, particularly in detecting light elements and ensuring thorough quality control.

LIBS Principles

Laser Induced Breakdown Spectroscopy (LIBS) is an optical emission tool for the quick characterization of chemical elements in a broad range of materials, including biological, geological, and ceramic materials. A highly energetic laser pulse is directed at the target sample (Figure 3), resulting in the creation of an expanding microplasma upon impact. This microplasma emits luminous species that provide valuable information about the material composition and the sample environment.

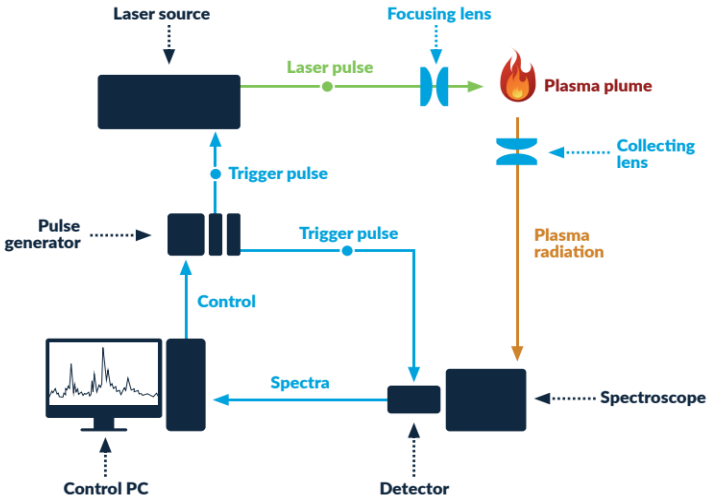

Figure 3: Sci-Trace LIBS set-up scheme

