Revolutionizing Plastic Recycling: Advanced Chlorine Detection with LIBS

Challenges

Plastic recycling is essential for sustainable resource management, but it comes with significant challenges, particularly concerning contamination. One of the critical risks in polypropylene recycling is the presence of chlorine (**Cl**), which can negatively affect the quality and safety of recycled products, inducing or fastening their degradation and even causing corrosion of manufacturing machines. Traditional methods for chlorine detection in recycled materials have limitations, making the **Laser-Induced Breakdown Spectroscopy** technique a valuable alternative.

Solutions

The challenge of detecting **chlorine** in recycled plastic samples, which contained concentrations below 1000 ppm, was addressed using our **Sci-Trace**. While direct measurement of halogens like chlorine is difficult due to their unique spectral characteristics, emerging techniques suggest that **LIBS** can still provide reliable detection. By analyzing molecular bands formed by fragment species in the plasma during the analysis as shown in the Figure 3, **LIBS** allows for the indirect detection of chlorine content.

Figure 1: Shredded sample

Figure 2: Granulated sample

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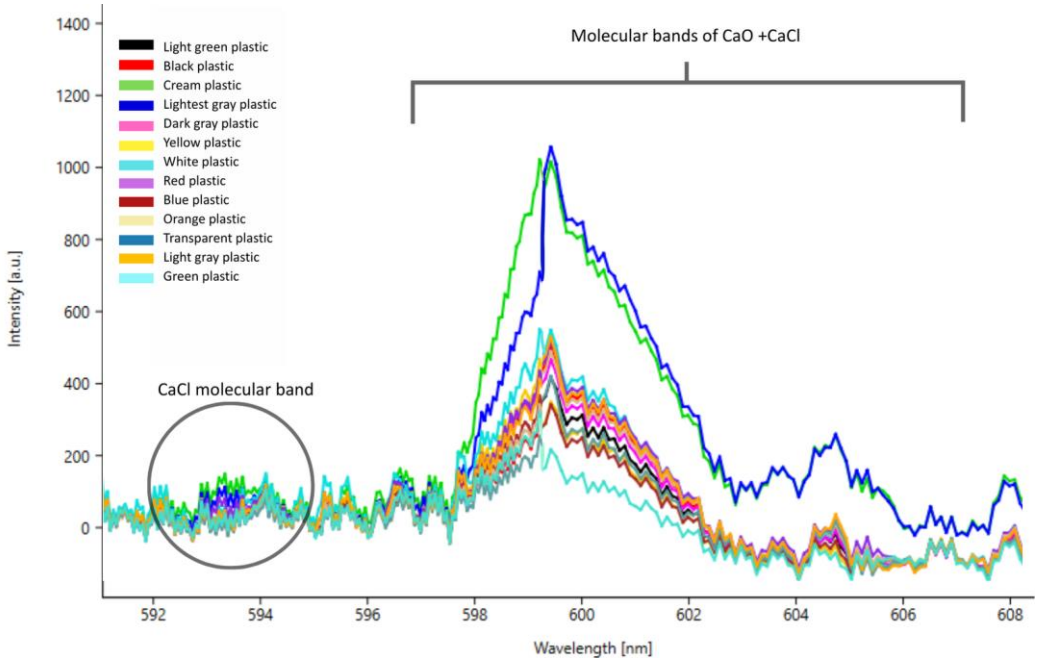

Figure 3: Molecular bands in PVC samples

Results

AtomTrace LIBS solutions successfully **detected molecular bands associated with chlorine, even in small amounts within recycled plastics.** This capability ensures that even low levels of chlorine contamination can be identified, enhancing the reliability of the recycling process.

Unlike conventional methods like X-ray fluorescence (XRF), which only measure surface contamination, **LIBS provides a more comprehensive analysis that includes bulk composition**. This allows for a deeper understanding of the material's overall integrity and contamination levels throughout, rather than just on the surface.

LIBS offers a deeper and more accurate analysis of materials, ensuring robust quality control. By **detecting contamination throughout the entire material**, **LIBS** helps prevent undetected impurities from entering the production process, ensuring that only high-quality, contaminant-free recycled plastics are used.

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 4), 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.

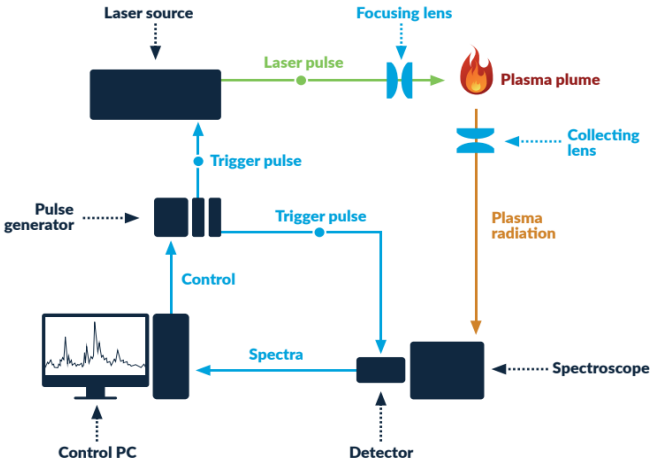

Figure 4: Sci-Trace LIBS set-up scheme

