Detection of contaminants (PVC, Al, Fe) in recycled PET flakes with Laser-induced breakdown spectroscopy

Gerald Schwödiauer[1], Stefan Trautner[1], Gundula Teichert[2], Thomas Krziwanek[2], Johannes D Pedarnig[1]

[1]Institute of Applied Physics, Johannes Kepler University, A-4040 Linz, Austria

[2]Teufelberger GmbH, A-4600 Wels, Austria

The recycling of polymers and the re-use of plastic waste are topics of steadily growing importance. The use of polymer recyclate as secondary raw material in industrial production requires the identification of impurities and their separation from the material stream. We investigate the capability of laser-induced breakdown spectroscopy (LIBS) to detect different types of impurities in flakes of recycled polyethylene terephthalate (PET). The impurities under investigation are small pieces of polyvinyl chloride (PVC), aluminum and iron which can have a negative impact on the re-use of the recycled material. LIBS spectra of the recyclate material are measured in the UV/VIS and NIR ranges in ambient air. The impurities are identified by detecting the optical emission lines of chemical elements that are characteristic for the different materials. For the detection of PVC, the emission lines of chlorine in the red and NIR range are used (Fig. 1). The same wavelength regime is used for iron detection. Aluminum is detected by their characteristic lines in the UV and NIR. A software program is developed for automatic evaluation of measured spectra that enables to identify impurities. Individual flakes of PVC, Al, and Fe and PET flakes covered by surface coating can be detected under certain conditions. Thin superficial layers on PET containing aluminum are detected also.

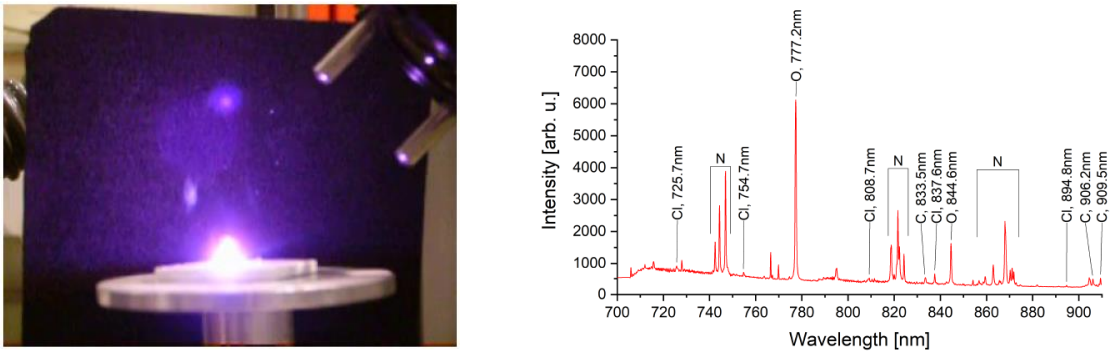

Fig. 1: Photograph of laser-induced plasma (left) and LIBS spectrum (right) of transparent PVC flake.

Acknowledgements

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