Digital model and simulation of glass recycling plants in the project MaxScherben

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Abstract

In the project MaxScherben the three organizations HVG, Uni Bayreuth and TAZ Spiegelau work together on the goal of maximizing the usage of fine cullet. Fine cullet is a section of material, which is too small to be sorted by the available sorting technology. The grain size is usually below 1 or 2mm. A clear definition of the grain size sections will be part of the project. The most crucial issue within the fine cullet fraction is the amount of organic material. The two other, less important, issues are CSP (ceramics, stones, porcelain) and handling of fine material. CSP with grain sizes below 2mm is small enough to melt in a typical furnace and has a little enough percentage to not affect the glass composition. The problems regarding the handling of fine fractions like foam, dust, or clumping will not cause significant problems but will also be investigated during the project. However, the amount of organic material also influences foaming and, which is way more critical, affects the redox reactions within the glass melt.

Exploring those effects and minimize them is part of the work in the MaxScherben project. One of the main objectives will be the detection of the carbon content and its composition. Therefore, laser-induced breakdown spectroscopy (LIBS) and plasma-induced gas analytics will be used. The effects of different organic impurities and percentages will be explored with a test series of crucible melts.

The important work package of modeling and simulation of glass recycling plants has already been started. This part of the project is necessary to gain knowledge about the plants, where fine material comes from and if it could be reduced during the process. The models will be used to find the right spot to remove the fine cullet and to evaluate if removal or a combined new fraction of fine and coarse material is necessary. The simulation should be able to show where and how much fine cullet is created in the process. Possible changes in the process are simulated and discussed.

The simulation will be based on a flow chart model of a recycling process. The first step is to model general needs in recycling and exemplary plants. The model will add properties of the different components and simulate the cullet processing in and between the components. The components are built up in a discrete event simulation environment.

Keywords: recycling, process, simulation, cullet, project

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