Discovering Ultra-Clean Cullet Crushing Technology

Overview
In order to produce a new and clearer product economically, Corning needs to utilize pure cullet. The current cullet crushing industrial process leaves metallic impurities, making it useless for ultra-clear glass manufacturing. Finding a way to economically crush clean cullet is vital to the organization.

Objectives
Corning requests that the design team researches and presents evidence regarding several alternative concepts to crushing cullet. This research will be used by Corning employees to further develop large scale solutions to the cullet crushing problem. Ideally, Corning wants to have several concepts with conclusive results to justify pursuing them.

Approach
- The design team met with Corning to understand the needs of the new crushing system. The primary objective was zero contaminants.
- The team researched current crushing technologies and decided to develop small scale setups for promising solutions.
- The team selected five concepts to pursue: Laser Cutting, Sonic Waves, Lichtenberg Effect, Microwave and Plasma Heating, and Thermal Shock.
- Each team member was responsible for researching and testing a single concept, coming together to discuss overall metrics.
- The sonic wave and microwave concepts were both tested in on campus labs. The sonic wave concept was tested in a vibration lab while the microwave concept was tested at the materials research institute.
- The thermal shock concept was not tested on campus due to lack of testing means. However, the concept seemed promising and additional research was completed.
- The laser cutting concept was not physically tested due to time constraints and concept certainty.
- The Lichtenberg Effect was found to be extremely dangerous to test. Therefore, the concept was not pursued, nor will it be suggested to Corning.

Outcomes
- The project provided Corning with five unique concepts to crush cullet.
- Of the five concepts researched, the design team recommended that Corning pursue microwave and plasma heating, thermal shock, and sonic waves.
- Sonic waves and thermal shock, while testing was inconclusive, has substantial research to qualify scalability in industry.
- A microwave generator can be purchased to produce cullet, seen in the Figure 1.

Figure 1. Depiction of microwave generator machine producing cullet.