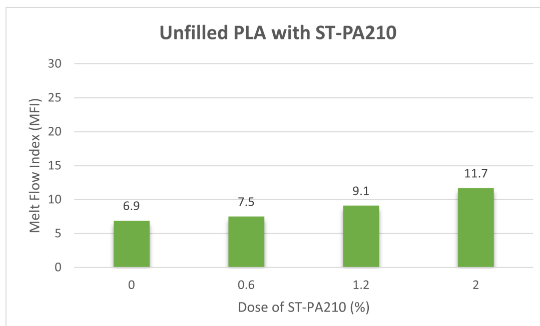
Understanding Melt Flow Additive Solutions As Food Safe Compliant

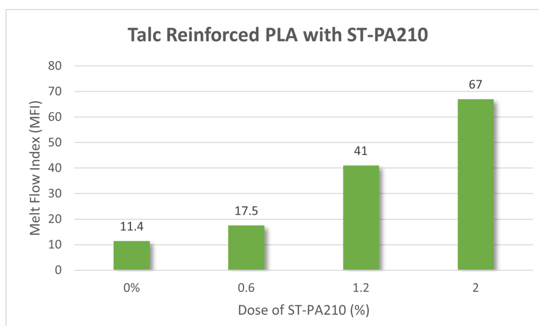
How temperature burndown data can be utilized to ensure flow improving additives can be used beneficially and to the point they are no longer present in final food contact applications.

Many processors working with PET, PLA, PC or other engineering resins often find difficulty with the natural viscosity of these polymers. While processing, high viscosity could prevent material from evenly flowing from extruders into mold cavities or through dies, causing irregularity in thickness of blown films, or complicating mold filling with slow moving material. These challenges cause not only frustrations to operators but significant costs as issues like these can cause problems in dimensional stability, turnover times, or cause defects that require extensive offcuts and adjustments, interrupting processing time.

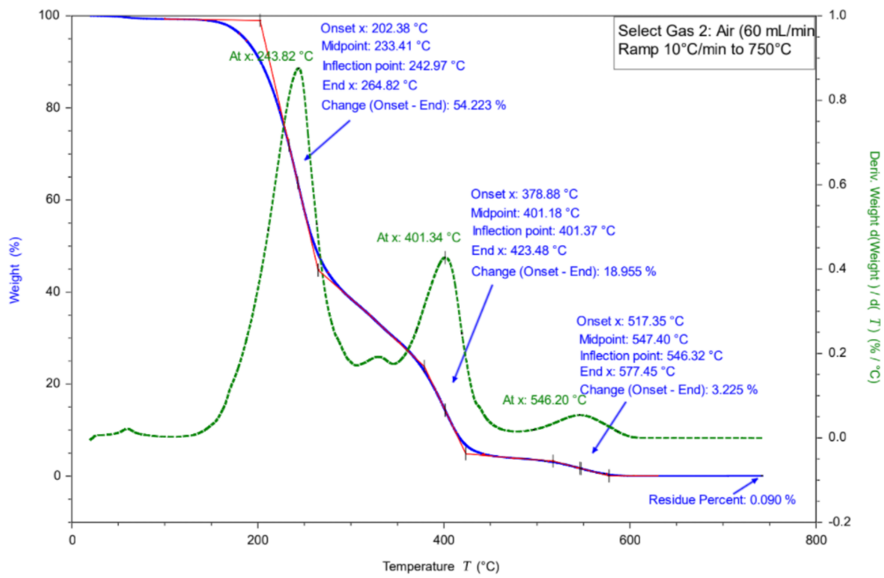
Take PLA as an example, the industry has seen a rapid uptick in PLA processing in response to market demand for effective biodegradability given the ever growing public scrutiny of the environmental impact of plastic materials. PLA, though, can have high viscosity particularly when compounders and producers need to use talc or other fillers to achieve their customers' required performance. This issue is particularly strongly felt in verticals such as agricultural films or disposable single use plastic food containers.

A key approach to dealing with highly viscous PLA compounds is the use of additives included at compounding time. One such low-dose, high-effect additive is ST-PA210™, offered by Massachusetts-based CAI Performance Additives. The additive provides a competitive result with talc filled polymers or neat resins. As you can see from these data, with doses as low as 1-2% ST-PA210™ can achieve 170% improvement to the melt flow in unfilled PLA, and 600% melt flow increase with talc filled PLA.





In the interest of the previously mentioned food-contact applications popular for PLA, CAI Performance Additives commissioned an independent agency to conduct a TGA burndown study of ST-PA210™ to better understand its thermal properties. This test was conducted by taking the material from room temperature through 750℃ at a ramp rate of 10℃/min while closely monitoring the weight and composition to emulate the thermal pressures it faces during the extrusion process as part of the compound. The results are shown in the graphic on the following page and findings discussed here.



The results of the test are clear; after simulating the processing environment of extrusion or injection molding, the additive itself is greatly removed. Only 0.090% of material was left after processing which at a 1% load would equate to 400ppm after 400℃ or just 90ppm after 600℃. While the extrusion temperatures for PLA are less than 400℃, we consider the heat history of the polymer will include both the compounding step and the final molding/extrusion step, the TGA data shows the additive will only be present in trace quantities after full processing. We can see therefore that this additive should be considered “sacrificial”, and that while processors see the desired loosening of the host polymer chains during processing, the additive will be essentially absent from the final product. This also means utilizing ST-PA210™ will leave no residual properties in the finally produced film or components. In addition we note there have been no observed mechanical property changes for processors currently using ST-PA210™.

In conclusion, compounded biodegradable materials (including PLA) that utilize ST-PA210™ as a flow improving agent can remain biodegradable. Also, because of the observed sacrificial nature of the additive, food contact regulation requirements should not be impacted by the additive as it will not be present in sufficient levels to cause leaching concerns for the final products in contact with foods. ST-PA210™ is highly effective at loosening polymer chains during process, significantly decreasing the viscosity of polymers in process while also being effectively consumed by the process and will be present in final molded or extruded products in only trace amounts.