

Auto-Al Scrap Material Flow Analysis with Compositional Projections

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EXTENDED ABSTRACT

This research is separated into two phases:

Phase 1: Document current day data on automotive scrap flow, model it, and predict the future influence of aluminum intensive vehicles (AIVs) on scrap market

The average North American light vehicle will consume about 200 lbs. more aluminum by 2025 in comparison to the 2012 average. This increase will most certainly affect the secondary aluminum production industry but the extent of this is presently unknown. The initial questions that need answers are: how much aluminum will be removed during the dismantling of an AIV and how much will be shredded? Most likely, there will not be a set standard for how to handle these vehicles based on current market and operating protocols/conditions. Considering this, these questions boil down to: *How will this strong increase in aluminum content effect the life cycle of automotive aluminum and composition of mixed auto-shred streams, like Twitch, when considering the extent of dismantling and market penetration of sorting system technologies utilizing LIBS and/or XRF?*

This life cycle analysis, conducted using a material flow analysis technique, will incorporate scenario-based studies where the input will not vary but the degree of dismantling will along with sorting capabilities. The extent of dismantling will affect the amount of auto-shred Zorba/Twitch being formed and will alter the recycling rate and domestic utilization rates. At the step of secondary smelting the Twitch, sorting system technology will be assumed to be capable of sorting the mixture into various constituent bins in order to form multiple secondary alloys. Here, a linear programming technique will be used to incorporate blending models into the study. The alloy that can be formed should be able to vary and financial fluctuations due to this will be analyzed.

Phase 2: Monitor the compositional variations in Twitch as a function of region and processing parameters (two distinct sorting technologies) and project the effect of AIVs on the Twitch composition

The task of characterizing Twitch compositions from various plants across the U.S. remains necessary in order to intelligently sort this scrap class at downstream separation systems. The chemical composition that is favorable to sort out from these mixed-streams is critical information and invaluable to the secondary recyclers in the United States and beyond. Investigating the regional, time and plant-specific effects on this compositional variance has proven to be an enormous task; too large to be carried out using lab-scale/handheld spectrographic or optoelectronic techniques. CR3 project, *Scrap Characterization to Optimize the Recycling Process*, attempted to tackle this investigation and developed an accurate method to determine unknown scrap distributions as a function of alloy/alloy series and chemical composition. However, this process consumed a large amount of time. Wasted time in the recovery industry leads to suffering profit margins and data collected over long periods of time results in

irrelevancy.

A real-time, automated scrap characterization device that can analyze a mixed-scrap sample in a few hours is required to conduct such a research task. The throughput of sample analysis must be increased to work towards representation of the industry at large. Three samples, from three different scrap processors in the U.S., are currently being sampled at a monthly rate. The specified amount of 100 lbs. is being extracted from the production line in steps of 25 lbs. at four different times throughout the month (*i.e. weekly*). These samples are then being sent directly to the site at which analysis will be taking place.

Two technologies are being utilized for the compositional characterization. An XRF analytical system is one technology being used. This machine is capable of sorting into 10 bins and can process 8,000 lbs. /hr. There will be no in-process weighing of individual aluminum scrap particulates, rather the sorted bins will be weighed at the end of analysis. This analysis will continue for 9 months or until a compositional consistency is observed for the current state of the market.

The second technology being used is the LIBS-based sorting system manufactured by Steinert. The pilot-scale system is in the process of being installed. In the near future (TBD), it will be utilized to sort into constituent bins according to expert recommendation and experimental efforts.