

## ABSTRACT

In collaboration with the Metal Processing Institute and the Center for Resource Recovery and Recycling, this project sought to develop sortation and blending models for aluminum automotive scrap. At present, 380 is the most commonly produced aluminum alloy. The models crafted in this project enable the secondary aluminum casting industry to produce a broader range of alloys than current methods allow.

## OBJECTIVES

- To analyze the market value of various aluminum alloys
- To develop a series of blending models that maximize recovery and profit from recycling aluminum automotive scrap (twitch)
- To analyze the economic viability of the proposed blending models

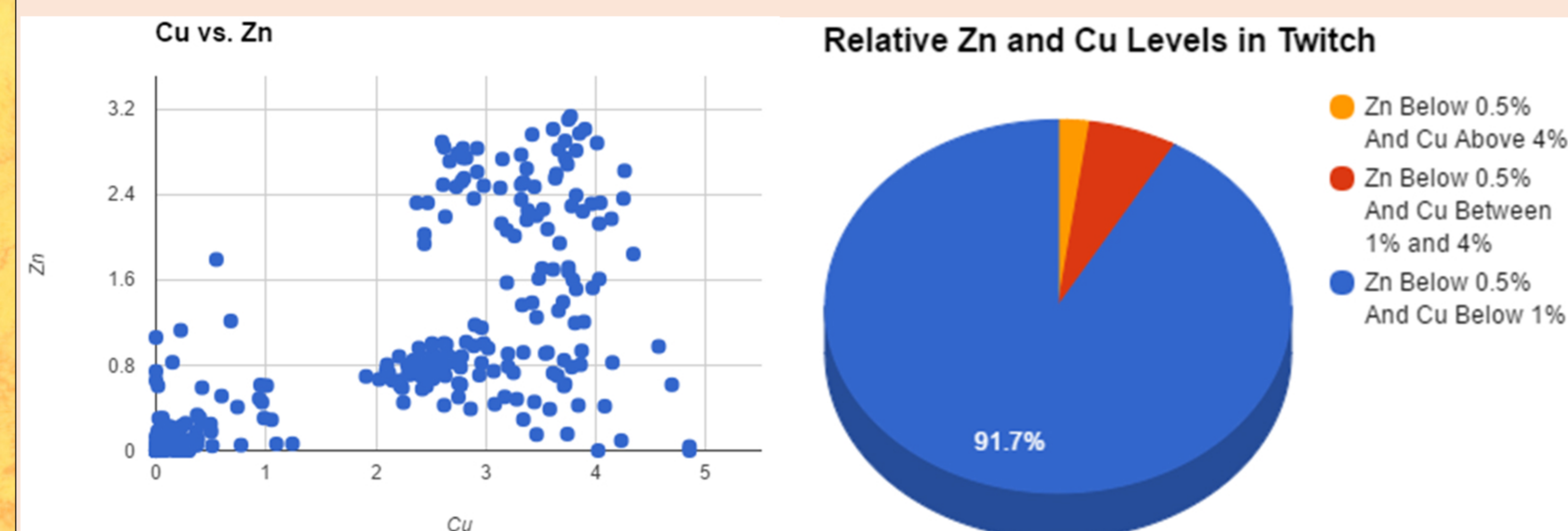
## METHODOLOGY

- Conduct market analysis by consulting industry professionals and American Metal Market for price and demand of alloys
- Determine chemical composition of 12.93kg (~30lbs) of twitch using X-Ray Florescence technology (XRF)
- Develop sortation and blending models around collected data
- Determine the economic feasibility of the sortation and blending models

## SORTATION RATIONALE

Specifications for Selected Alloys

| Alloy | Cu%     | Fe% | Zn%  | Al%       | Mg%       | Si%     |
|-------|---------|-----|------|-----------|-----------|---------|
| 319   | 3.0-4.0 | 1.0 | 1.0  | Remainder | 0.10      | 5.5-6.5 |
| 360   | 0.60    | 2.0 | 0.50 | Remainder | 0.40-0.60 | 9.0-10. |
| 390   | 4.0-5.0 | 1.3 | 0.10 | Remainder | 0.45-0.65 | 16-18   |



| Alloy | Sortation Conditions   |
|-------|--|
| 319   | (Mg<0.5% AND Fe<0.2%) OR (2.0%<Cu<5.0%) OR (Si<3.5% AND Mg <2.0%) OR (Al >90%) |
| 360   | (Cu<2.6%)  |
| 390   | (Zn<0.5% AND Mg<1.5% AND Fe<3.0%)  |

## SORTATION RESULTS

| Alloy | Cu%  | Fe%  | Zn%  | Al%  | Mg%  | Si% | % Recovered |
|-------|------|------|------|------|------|-----|-------------|
| 319   | 1.4  | 0.74 | 0.83 | 90.0 | 0.99 | 5.1 | 90          |
| 360   | 0.59 | 0.73 | 0.36 | 91.0 | 1.3  | 4.6 | 51          |
| 390   | 2.8  | 0.97 | 1.3  | 85.0 | 0.64 | 9.3 | 41          |

Values in red do not meet alloy specifications. The following additives were used to correct the melt:

- 319 – Add Cu, Si; Remove Mg
- 360 – Add Si; Remove Mg
- 390 – Add Cu, Si

## ECONOMIC IMPACT

Net Revenue

| Alloy | Profit Per 100 lbs | Revenue Increase |
|-------|--------------------|------------------|
| 380   | \$19.00            | \$0.00           |
| 319   | \$24.10            | \$5.10           |
| 360   | \$24.10            | \$5.10           |

Compared to solely producing 380 from twitch, our sortation methods increase the revenue yield by \$5.10 for every 100 pounds.

## CONCLUSION

The results of our blending models affirm that it is possible to form 319, 360 and 390 alloys from twitch. Additionally, an economic analysis of our models prove the blending models to be more economically favorable than current recycling methods.

Recommendations:

- Reduced magnesium in primary aluminum would increase the financial viability of secondary aluminum production
- Further research should focus on identifying aluminum alloys that can be formed more readily from twitch

### WORKS CITED

American Metal Market. AMM. nd. Web. 1<sup>st</sup> November 2016.  
Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Casting and Ingots. Arlington. The Aluminum Association Inc. 2015. PDF.  
Kelly, Sean. Personal interview. 1<sup>st</sup> December, 2016.  
Weritz, John. Phone interview. 17th November, 2016.