

## INTALCO'S EXPERIENCE WITH THE

### ALCAN TAC SYSTEM

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Lithium has become a common bath additive in aluminum reduction cells in recent years. It has also become obvious that residual Lithium content has undesirable effects in casting and other downstream operations. Intalco has been testing Lithium in the potlines for many years. When it became evident that it would become a normal part of the operation, the casthouse began to test the effects of residual Li in trace quantities in casting and in the fabrication of our products.

The major effects in casting seem to be the result of an increased oxidation potential caused by Li concentration at the surface of the metal. This effect is manifested as increased dross formation in troughs and launders, a dull surface on as-cast product, and a tendency toward surface defects, particularly on large size billet. The only confirmed problem after casting is the "blue haze" corrosion phenomenon in foil and sheet products.

Our normal levels of Li in the cast product were expected to be 8-10 ppm with full Li bath modification in the potlines. The generally accepted maximum level for cast products is less than 3 ppm with some products as low as 1 ppm. Since much of our metal is exported as pure metal with an undetermined end use, a felt it necessary to reduce the Li level in all metal produced to 3 ppm or less.

In 1982 we began a search for methods available to accomplish this reduction. We found that most options were not very good. Some of the methods for reducing Lithium levels which are used commercially are discussed briefly here.

Furnace degassing is a rather standard method for reducing the Sodium content in the metal. It also reduces Lithium, but at a much slower rate. Long holding and degassing times are required to reduce Li to the desired levels. Since our furnaces were not originally built for degassing, this method would have required a large capital outlay for scrubbers and reduced casting productivities drastically because of the extra time needed for degassing.

Carbon filtration is used effectively in some casthouses in conjunction with other methods. It can achieve the desired result on Li levels alone, but requires large quantities of charcoal and generates a disposal problem for the spent carbon. The cost of operation would be relatively high if this method were used as the primary means of reducing Li.

Spinning nozzle degassing is effective for Na reduction and has other benefits, but generally this process removes only about 50% of Li in the metal depending on metal flow rates and gas used. Installation of spinning nozzle filtration capacity primarily as a means of Li removal would be very expensive since a unit is required for each casting unit and both capital and operating costs would be prohibitive. In addition to these factors, Intalco has relatively small casting pits and does not have the required space.

Tabular AIF<sub>3</sub> filtration was used briefly by Alcan prior to the introduction of the TAC system.

Alcan's TAC System was in operation at two Alcan plants and promised very good results with a minimum operating cost and a modest capital investment. After testing, this system was chosen for installation at Intalco.

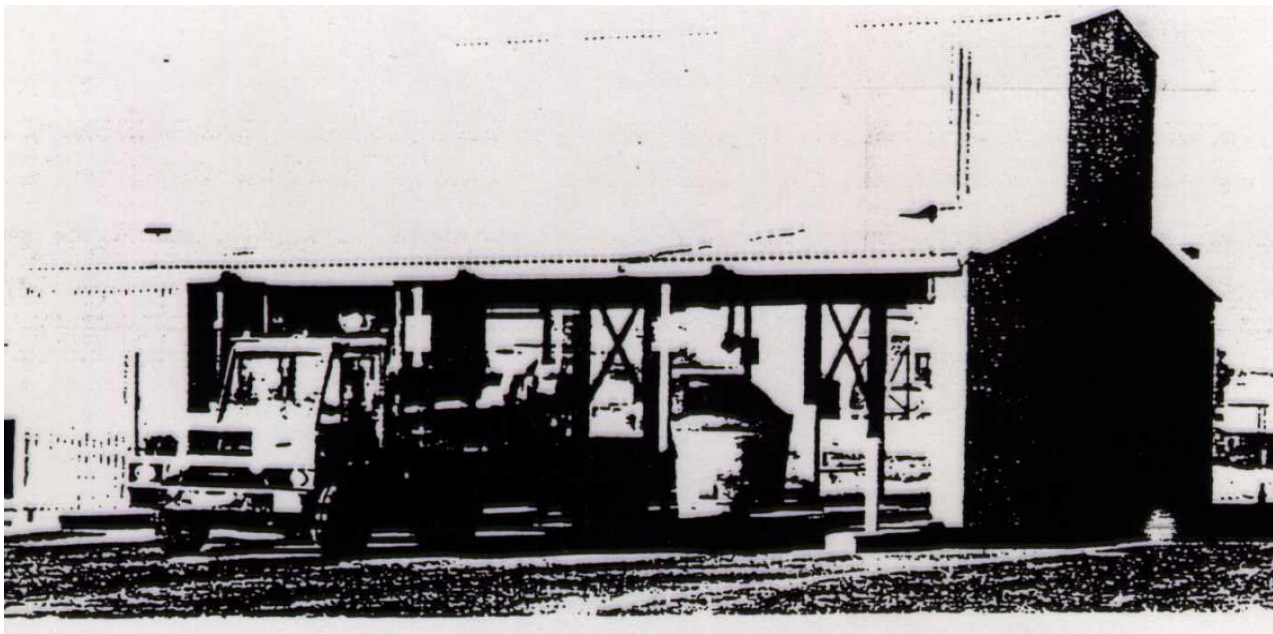
#### DESCRIPTION OF THE TAC SYSTEM

The Alcan patented TAC system as described by Dube and Newberry (1) in a 1983 AIME paper. "TAC" stands for "Treatment of Aluminum in Crucibles." AIF<sub>3</sub> powder is added to molten aluminum in a ladle while stirring and creating a vortex with an impeller. Figure 1 shows a schematic of the process.

Alcan performed water model studies of our crucible to determine the size, speed and placement of the impeller for the best efficiency of treatment.

#### APPLICATION AT INTALCO

At Intalco, metal is transported in ladles from the potlines to the casthouse by truck. The treatment system is a 3-station drive through unit located in a small building between the potlines and casthouse. The truck simply drives in from one side, drops the ladle for treatment, and exits the other. The truck (and ladle) is centered by guide curbs for the truck tires. Electronic sensors signal the driver when the ladle is in the correct fore/aft position and tell him to go forward or backward if necessary. (The truck has a reflector attached on the side which is read by several sensors.) The driver then lowers the ladle and drives forward. After the truck has pulled away from the station, the rotor and hood descend onto the ladle and treatment takes place automatically. When treatment is



The Intalco TAC Treatment Station

complete, the hood raises and the driver picks up the ladle and continues to the casthouse. Total elapsed time is less than 10 minutes for a 6 minute stir time.

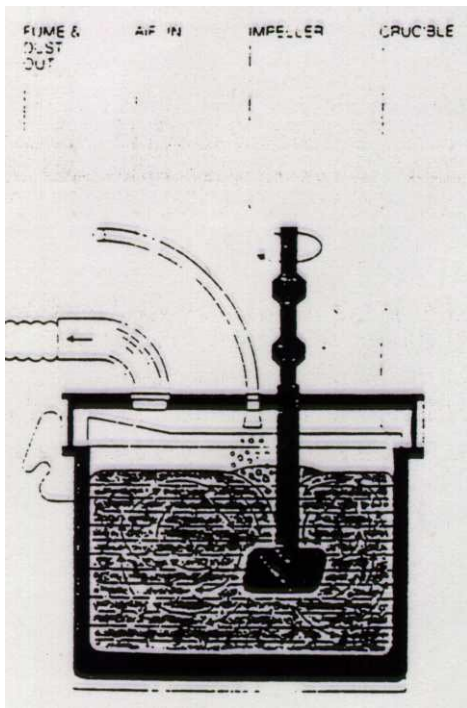


Figure 1 Schematic Diagram of the TAC Process

Normally, we can treat all metal with one station down for maintenance, but the third station is necessary when metal transfer falls behind for some other reason. This "catch up" capacity is necessary to accommodate normal problems in tapping or in the casthouse.

The system required no manning increase; it operates automatically and is monitored by the drivers. The extra time requirement for the drivers is about 10 minutes per trip (a driver makes 15 trips in 8 hours) and is partially offset by the elimination of ladle skimming which previously took about 5 minutes per trip. The only other attention required is to keep the AIF3 hopper filled and the baghouse discharge emptied. This work is done on a regular schedule 3 times per week.

The station physically consists of an AIF3 bin and charge system, a baghouse, an hydraulic system for turning the rotors and raising and lowering, the hoods and a programmable controller which operates the system.

Capital costs for installation were \$280,000 for this 3-rotor station capable of treating all the metal for the 280,000 tpy plant. Operating Costs for this year have been \$.0002 per pound. Rotors cost about \$450 each and last for 600 ladles (each ladle holds an average of 11, 000 pounds of metal). Maintenance costs for the unit for the past year were \$76,000 and the cost of rotors was \$37, 000. These figures do not include the cost for AIF3 since this material is recycled to the pots.

## RESULTS

The system has been fully operational at Intalco since June 1984.

Performance criteria for the design of the system was the reduction of Li content in our 12,000 pound ladle from 12-14 ppm to less than 3 ppm in 6 minutes with an AIF<sub>3</sub> addition rate of 1 pound per thousand pounds Al.

Before purchasing the system, we operated a portable treatment station supplied by Alcan. The results of a week-long test are shown in Figure 2. Each test was run starting with a clean ladle and adding the prescribed AIF<sub>3</sub> dosage to this ladle each cycle for several shifts. Metal was sampled during some treatments at 2 minute intervals.

The recommendation based on this test was that we add 1 pound AIF<sub>3</sub> per 1,000 pounds aluminum and stir for 6 minutes. This treatment would achieve our goal of 3 ppm Li and allow the truck drivers time to haul all the metal.

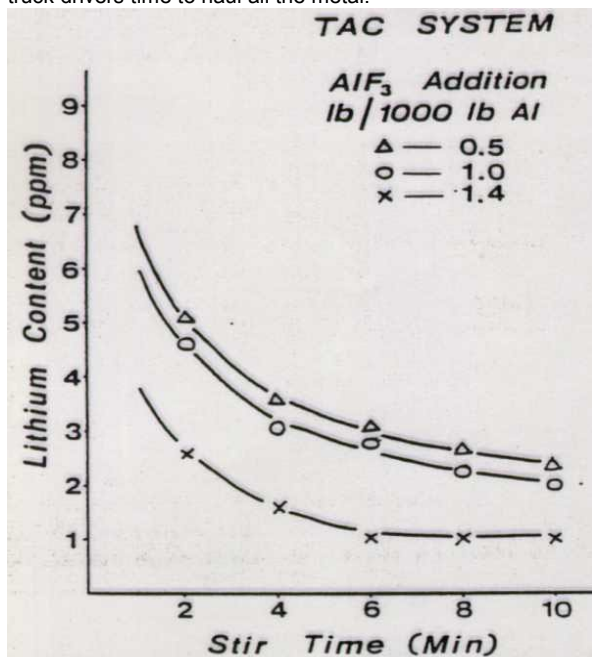


Figure 2. Lithium level in the metal vs. treatment time. These results were established during preliminary testing at Intalco.

We began additions at this level after installation of our system. However, after the system stabilized, we found that the Li levels were generally 0 ppm. We feel the increase in efficiency compared to the test was due to the permeation of the ladle linings by the excess AIF<sub>3</sub> being added.

We reduced the AIF<sub>3</sub> charge gradually and monitored the Li to see what happened. Currently we are adding 0.4 pounds/1,000 and stirring for 6 minutes with Li levels consistently between 0-2 ppm. Sodium and Calcium levels are consistently 0 ppm. The original performance criteria have been surpassed significantly by the production installation.

We have seen the results of the decreased Lithium content in the casthouse. Molten metal color has brightened and launder skimmings are reduced. Dross generation of the total casthouse has decreased by 5-10% and the metal recovered from this dross has dropped from 50% to 46% since the startup of the system (a rotary salt barrel is used for processing dross). These numbers indicate a reduction of melt loss in the casthouse, but it is very difficult to quantify since the mix of alloys cast is rather fluid and this also affects the melt loss.

## PROBLEMS

### Ladle Cleanings

Ladle cleaning has become much more difficult. The deposits are much harder and adhere tightly to the ladle lining. Work has begun on installation of a larger ladle cleaning machine to handle the problem.

### Smoke

Smoke is generated from the ladles, particularly when empty, as they pass through the casthouse and potlines. In an enclosed area, this smoke is quite nauseous and generates employee complaints. Tests have been made for exposure to F and particulate in these areas and no violations of the TLV'S have been found, but the problem must be dealt with.

We feel that better and more frequent ladle cleaning will help and are preparing to increase ventilation in certain problem areas.

### Rotor

Rotor life was initially a problem. The original design bent during use and caused a severe vibration. The problem was solved by increasing the diameter of the shaft and changing the alloy of the rotor. This new alloy gave a very short life because of erosion problems and caused us to return to the original alloy. We are now achieving twice the predicted rotor life so this problem has been solved very satisfactorily.

## CONCLUSION

The TAC system is by far the most effective method of achieving Lithium reduction that we know of, especially for large quantities of metal.

Costs for more than a year of operation have been \$.0002 per pound of metal treated excluding royalty costs. When compared to the cost of any of the alternative methods mentioned at the beginning of this paper, there is no comparison.

The system is simple and easy to operate, no manning is required and there are no specialized or exotic parts. No disposal or pollution problems are created.

## REFERENCES

1. G. Dube and V. J. Newberry, "Treatment Of Aluminum in Crucibles" (Paper presented at the 112th AIME Annual meeting, Atlanta, Georgia, 6-10 March 1983), 991