

Plasma Applications Aluminum Supplement

oneatmosphereplasma.com

e-Ion Plasma™ Devices for Aluminum Applications

(see also www.oneatmosphereplasma.com)

- Save dross loss in existing and new furnaces.
- Cleaner metal.
- Close to 100% energy conversion for e-Ion units.
- High environment impact.
- Competitiveness with patents and trade secrets.
- @\$1500 /ton and 33 million tons production annually. Annual saving with 2% dross (metal content) reduction (note in reality dross loss is 5-15%) savings are **\$990 million. Add to this savings from nitrogen use, energy savings and improved metal quality!**



Graph shows aluminum prices are increasing.

Aluminum Industry

The aluminum industry is one of the most energy intensive industries in the world. Compared with other competing materials such as steel, copper, wood, glass, and plastics, etc., aluminum has the highest energy content. The availability for the optimum furnaces for aluminum melting/casting and heat-treating will certainly improve the competitive position of aluminum vs. other materials. Our Aluminum Melting Furnace brings several immediate benefits to the vast aluminum industry.

Reduced energy consumption will be the number one payoff. In 1996, U.S. primary aluminum production was about 3.6 million tons while secondary aluminum recovery was about 3.3 million tons. The average energy consumption for producing primary aluminum is about 16,500 kWh/ton, in which 5.5% (~908 kWh/ton) is consumed for melting/casting. On the other hand, the average energy consumption for producing secondary aluminum is about 6% of that required for primary aluminum.

The total energy consumed for melting/casting aluminum (both primary and secondary) in the U. S. per year is thus approximately $(3.6 \times 10^6 \text{ tons} \times 908 \text{ kWh/ton} + 3.3 \times 10^6 \text{ tons} \times 990 \text{ kWh/ton}) = 6.5 \times 10^9 \text{ kWh}$ ($22.3 \times 10^{12} \text{ Btu}$). Assuming a 40% improvement in energy efficiency by using the heat source furnace of the type Aluminum Melting furnace and a 100% market penetration would result in a total energy saving of $\sim 2.6 \times 10^9 \text{ kWh}$ ($0.88 \times 10^{13} \text{ Btu}$) for the U. S. aluminum industry per year.

A small saving of even 2 % can yield close to a \$1 Billion Dollar Revenue.

{ The new technology disclosed in this document will save you significant dollars. Read on... }

The Creation Of Dross

Dross is the layer formed on surface metal when molten aluminum is exposed to oxygen at high temperatures. This layer of oxidized metal is a nuisance to the industry; it has no value. Around 5-15% of Aluminum is consumed by dross per year. Due to the current high energy prices this is a big loss.

Several traditional techniques are used to reduce dross and prevent metal loss: **gas cover** and **toxic fluxes**.



Oxidation and dross

TRADITIONAL WAYS TO REDUCE DROSS

Gas Cover: Nitrogen and Argon gases are introduced into a furnace chamber to reduce the presence of oxygen and lower the rate of dross formation.

Pros: Effectively reduces dross in the melting process.

Cons: Requires large quantities of gases on site. Cool gasses can quench the metal surface. This increases the power required to maintain the melt state. You pay for gasses!

Chemical Fluxes (could be toxic): Fluxes are used to reduce dross.

Pros: Insures dross level will be low.

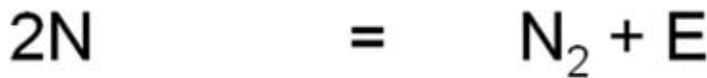
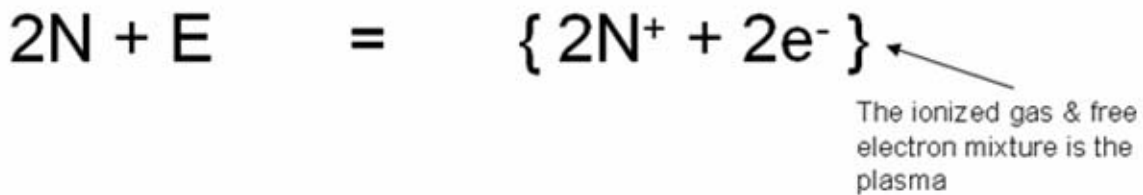
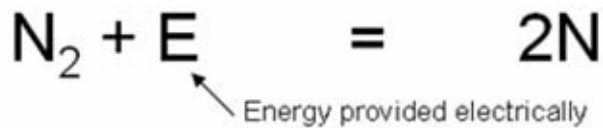
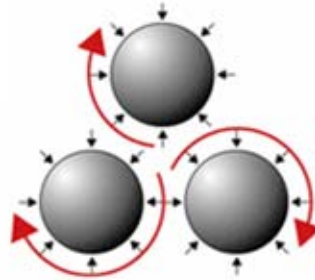
Cons: Contaminates the metal thus lowering the metal grade; creates pollution. You pay for chemicals!

NEW METHOD TO REDUCE DROSS

MHI's e-Ion Plasma™ eliminates the need for expensive gasses or chemical fluxes.

{ This new technology will eliminate consumption of fluxes and costly gases. Read on... }

e-Ion Plasma™ Devices - Principle

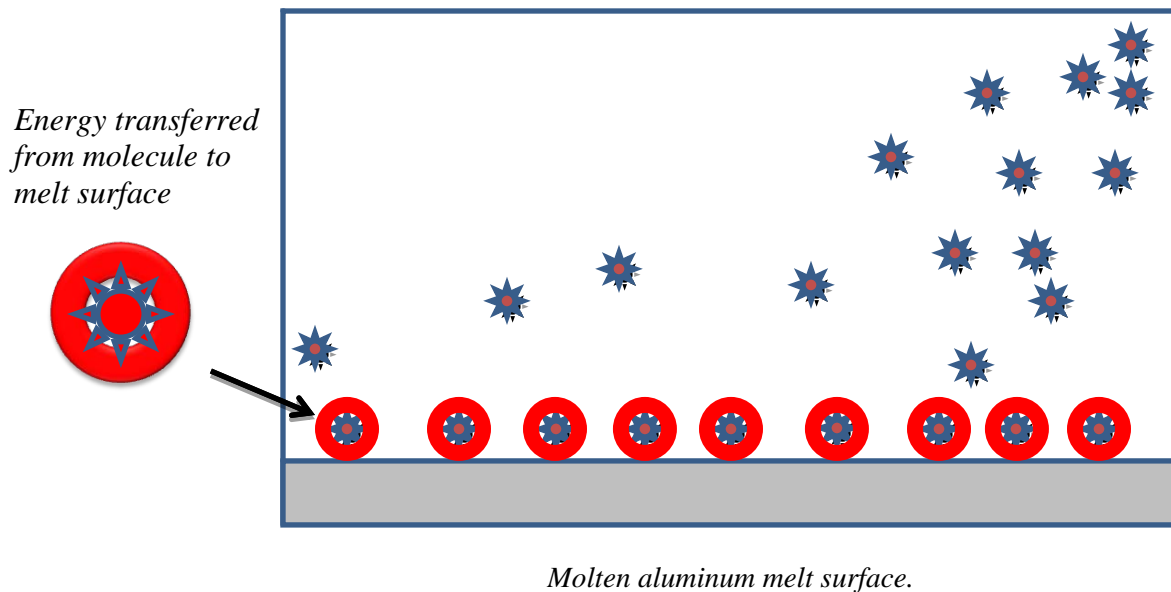


The basics of plasma heating and nitrogen cover. (see www.oneatmosphereplasma.com)

{ *How does it work? Read on...* }

e-Ion Plasma™ Cover

Applying an e-Ion Plasma™ Cover is a novel way to protect molten aluminum. The ionized gas eliminates the need for inert atmospheres or fluxes. Heat is also transferred from the molecule to the molten metal thus keeping the surface hot and ready to pour.



The ionized molecule gives off energy as it contacts the surface of the melting providing additional heat & cover before exiting the chamber.

{ *With a plasma cover you get the following benefits. Read on...* }

Benefits Of a Plasma Cover

- Key to melting aluminum cleanly and efficiently.
- Key to high productivity in the aluminum industry (highest melt rates).
- Dross values less than 0.5%.
- **Energy efficiencies of 0.2kWhr/lb with no emissions** (or improve energy efficiency in existing furnaces).
- Extremely small foot-prints.
- **Quiet** (not like conventional plasmas which are very noisy). Improved worker acceptance.
- Close to 100% power transfer efficiency of plasma device- again compare with low efficiency conventional plasmas.
- No need for nitrogen, argon or fluxes.

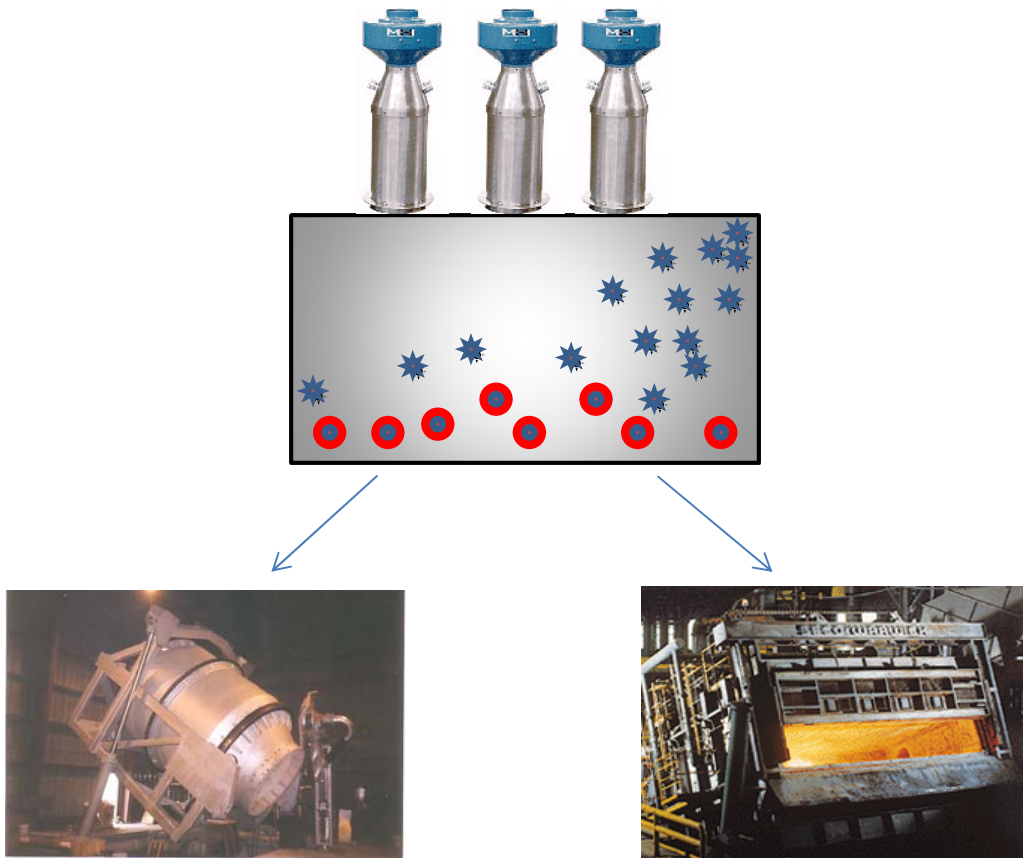


The benefit of a plasma cover used during melting are shown above. The melt on the left does not shown any signs of dross compared to the melt on the right.

{ Like the benefits? Here's more ideas. Read on... }

Retrofitting @ h o To Existing Aluminum Furnaces

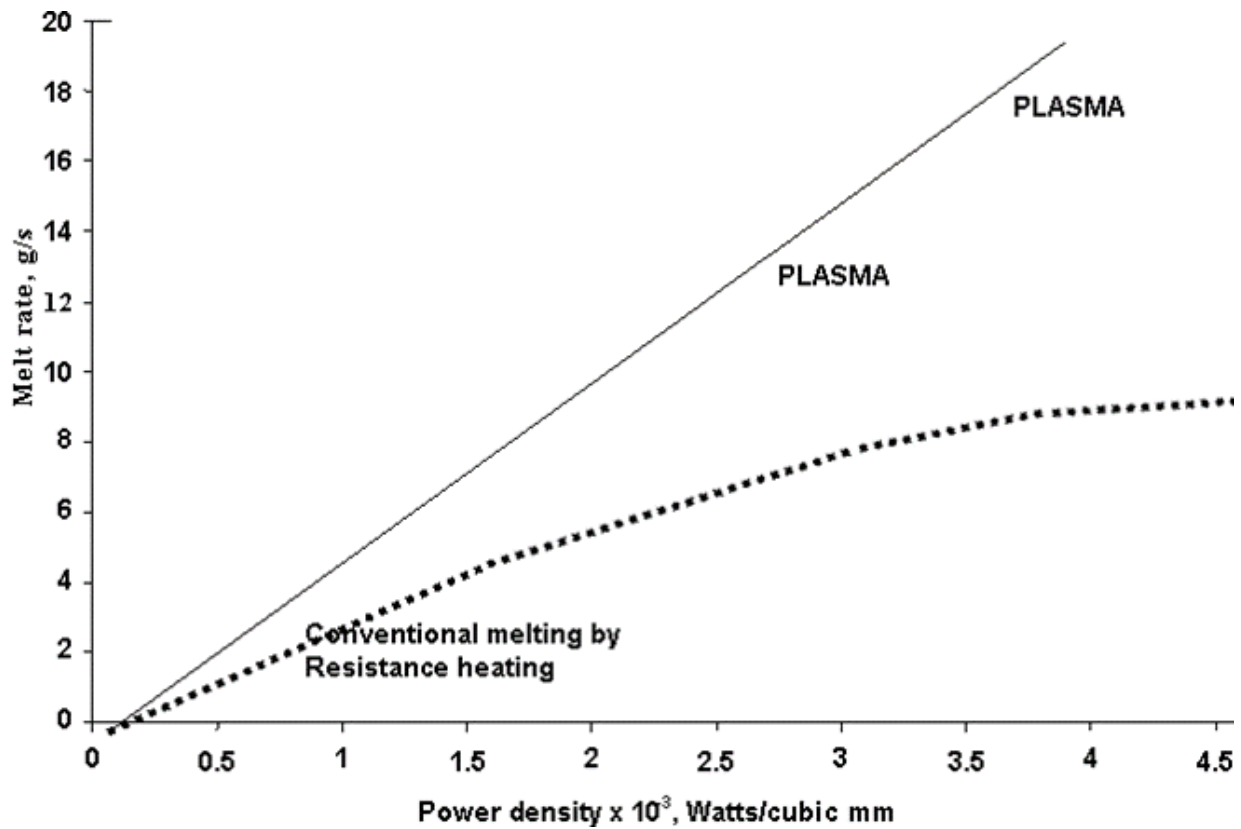
A quiet e-Ion Plasma™ is easy to add to an existing melting furnace. The unit is best applied by allowing the cover to be downward firing. e-Ion Plasma™ devices may also be used horizontally. See illustrations below.



{ *Want to compare furnaces? Read on...* }

Performance Comparison

Conventional furnaces are unable to create heat on the charge and their efficiency falls off. Plasma assisted furnaces automatically have high power densities and heat transfers directly to the part.



{ See the furnace comparison in attached article. Read on... }

Summary

Over the years, the aluminum casting industry has been looking for an energy efficient rapid melting furnace with reduced losses from oxidation and contamination. To accomplish these goals combined with energy efficiency, the furnace design must incorporate systems, which allow directing highly concentrated heat on the aluminum ingots, sprues or scrap.

e-Ion Plasma™ Technology is able to eliminate many aluminum processing issues and improve production efficiency. Typical benefits include:

- Save dross loss in existing and new furnaces.
- Cleaner metal.
- Close to 100% energy conversion for ion units.
- High environment impact.
- Competitiveness with patents and trade secrets.
- @\$1500 /ton and 33 million tons production annually. Annual saving with 2% dross (metal content) reduction savings are **\$990 million. Add to this savings from nitrogen use, energy savings and improved metal quality!**

e-Ion Plasma™ technology saves time, energy and money. Contact MHI today.

For more information, please contact Kevin Foston at:

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