

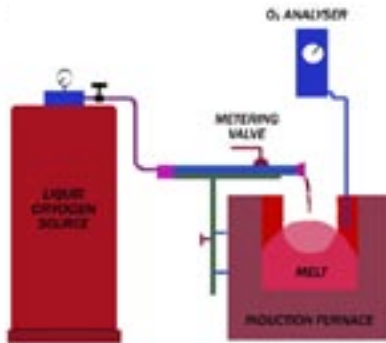
# SPAL<sup>TM</sup>



surface  
protection by  
Air Liquide

## **Improve Your Game and Save Money with Air Liquide Technologies.**

From golf club head to gas turbine and propeller manufacturers, companies across the globe are producing higher quality products for less with Air Liquide technologies. They are doing it with our patented SPAL<sup>TM</sup> technology. SPAL<sup>TM</sup> enables foundries to melt cleaner metal for producing castings with fewer defects, enhanced mechanical properties and with lower costs, which puts money in your pocket.



## Method and Benefits

Air Liquide's patented SPAL™ process uses cryogenic liquids, i.e. argon or nitrogen, to shield molten metal from harmful ambient air components, such as oxygen, water vapor, and carbon dioxide, during melting operations. The SPAL™ benefits are derived through two main mechanisms:

1. Cryogenic liquid when applied to the surface of the molten metal vaporizes instantly creating a thin inert barrier between the metal surface and atmospheric gases.
2. The transformation of liquid to gas takes place with a significant volume expansion (840 times for argon, 697 times for nitrogen) that displaces or purges the oxidizing gases from the metal surface.

Our cryogenic process has been proven superior to any gas inerting approach. The main benefits for your operation are as follows:

- Low slag or dross formation reduces heat time. The decreased metal/furnace liner reaction at the melt line reduces probability of slag formation. Alloy additions are rapidly consumed by the metal and melt temperatures can be lowered.
- Lower dissolved oxygen content provides fluidity, improving filling and feeding characteristics. The reduction in dissolved gas can reduce scrap typically caused by porosity and no-fill.
- Scrap and re-work are reduced due to less no-fill, cold shut, matrix and surface gas, inclusions from furnace refractories and re-oxidation during stirring.
- Increased furnace liner life. The life of the furnace liner may increase up to 3 times its average lifespan. The time/material savings will vary by foundry.
- Yield improvement for metal and additions due to the lower oxygen partial pressure over the melt surface.
- Superior mechanical properties with a reduction of metal defects after casting.

## Success Stories

A US manufacturer producing 15-5 stainless steel propellers applied the SPAL™ process to their investment casting operation.

The SPAL™ process enabled a 400% return in savings over the cost of SPAL™. Most of the savings came from a reduction in the finishing and polishing cost of the stainless steel propellers due to significant reduction in oxides and inclusions in the castings.

An automotive shell casting foundry in the Midwest producing 25% chrome iron alloy castings for truck engine manifolds applied the SPAL™ process to their robotic casting operation.

The SPAL™ process enabled a 50% reduction in green scrap, a 35% reduction in casting weld repair, and a 100% increase in furnace lining life, which resulted in \$10,000 per month furnace lining savings.

A refining arc re-melting process for alloy pig and revert material was completely eliminated from the robotic casting operation due to the cleaner metal produced with the SPAL™ process.

## Contacts

AIR LIQUIDE INDUSTRIAL U.S. LP  
2700 Post Oak Boulevard  
Houston, Texas 77056-8229  
Phone (800) 820 2522  
Fax (877) 715 4799  
[us.info@airliquide.com](mailto:us.info@airliquide.com)



Founded in 1902 and now present in 70 countries with nearly 36,000 employees, **Air Liquide** is the **world leader** in industrial and medical gases and related services. The Group offers **innovative solutions** based on constantly enhanced **technologies** to help manufacture many indispensable everyday products and preserve life.

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