Phosphorus-Copper Alloys

Milward

Aluminum & Copper Master Alloys

Phosphorus-Copper from Milward A
your process and eliminates the po

Phosphorus-Copper is an alloy of elemental copper and elemental ph

15% Phosphorus-Copper for the Copper Industry

Grade PS-4412: Brazing rod quality that contains a maximum of 0.020% iron.

Grade PS-4415: Mill quality that contains a maximum of 0.035% iron.

Grade PS-4420: Commercial grade that contains a maximum of 0.15% iron.

Application: Deoxidant

Removes oxygen from copper baths to produce a product free of cupric oxide. The reaction product ($P_2 O_5$) is a gas, which boils and is completely eliminated from the alloy, leaving no slag residual.

Recommended Addition Procedure:

1. Calculate the addition precisely.
2. Adjust the bath temperature as close to the final operating temperature as possible.
3. Skim the surface area of the bath.
4. If you are using shot, add in a continuous stream using the vibratory feeder.
5. Gently mix the bath with mechanical stirring, induction stirring, or the cascading method.

Precautions:

Problem: Pasty blue-green surface.

Solution: Keep the Phosphorus-Copper dry.

Note: *If this occurs, do not add the Phosphorus-Copper to molten metal. Consult your Milward Alloys representative, or call Milward Alloys before use.*

Problem: How to avoid re-oxidation.

Solution: Add a measurable surplus of Milward's Phosphorus-Copper as late in your process as possible.

Problem: Excess phosphorus substantially reduces electrical conductivity.

Solution: Add only enough phosphorus to remove the oxygen - more is not better.

Application: Alloying Agent

Increases the strength, hardness and elasticity, while reducing creep and grain growth, when added to copper and copper-tin alloys, and in high performance electrical conductivity alloys.

Recommended Addition Procedure:

1. Calculate the addition precisely.
2. Adjust the bath temperature as close to the final operating temperature as possible.
3. Skim the surface free of drosses or cover.
4. Add the Phosphorus-Copper in waffle or shot form.

Precautions:

- Apply a protective cover to the surface after alloying.
- Always keep the Phosphorus-Copper dry.

Application: Wetting Agent

Phosphorus-Copper is also used as a wetting agent in brazing alloys. Brazing rod producers add phosphorus to brazing rod compositions to:

- Lower melting temperatures.
- Improve wetting characteristics.
- Clean the brazed joint.
- Improve strength.

Recommended Addition Procedure and Precautions:

The recommended addition procedure and precautions for using Phosphorus-Copper as a wetting agent are the same as described for use as an alloying agent.

Alloys improves the predictability of tential for hydrogen embrittlement

nosphorus free of residuals, such as iron, silicon, arsenic and selenium.

8% Phosphorus-Copper for the Aluminum Industry

Grade PS-4410: Commercial grade that contains a maximum of 0.15% iron.

Application: Nucleant

Phosphorus-Copper is used as a nucleant in greater than 11% Silicon-Aluminum. When added to Silicon-Aluminum, Phosphorus-Copper forms AlP, which causes silicon to solidify as small, blocky particles instead of long, brittle fingers. This results in improved toughness, wear-resistance, castability and machinability.

Recommended Addition Procedure:

1. Calculate the addition of 0.02% to 0.04% precisely.
2. Adjust the metal temperature to 1335˚ to 1450˚F (724˚ to 788˚C).
3. Skim drosses.
4. Broadcast 8% Phosphorus-Copper shot over as wide an area as possible.
5. Wait five (5) minutes.
6. Gently, but thoroughly and mechanically, hand-mix the bath. Do not depend on gas bubble stirring, which tends to remove the phosphorus.

Precautions:

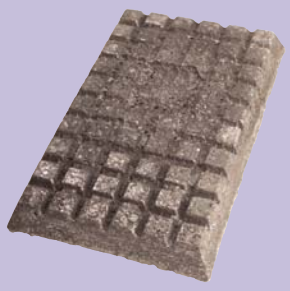
- The reaction of Cu_3P to AlP is very **hot** and very **fast**.
- AlP tends to float. If it is in contact with the air, it vigorously forms aluminum oxide and phosphorus pentoxide, which burns.
- The more phosphorus added, and the more concentrated the addition agent, the hotter the reaction. The AlP particles will be larger and will rise and burn faster than you will be able to cast the treated alloy.

Counter-Procedures:

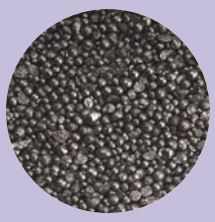
- Add 8% Phosphorus-Copper instead of 15%.
- Add fine shot instead of coarse shot.
- Add Phosphorus-Copper later in the process rather than earlier.
- ***Always keep Phosphorus-Copper DRY.***

Phosphorus-Copper

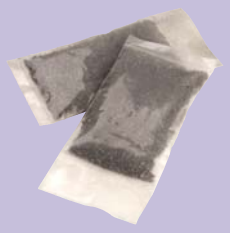
Forms Available



Waffle: 9" x 15" x 1-1/2" (23 cm x 38 cm x 4 cm) approximately 50 lb. (23 kg)



Shot: between (3/8" x 1/16") or (10 mm x 2 mm) available in increments of 1/16" (2 mm)



Shot/Bags: supplied in small, sealed plastic bags, 2-oz., 4-oz. or 6-oz. (60 g to 180 g)

Packaging

Milward's world-class Phosphorus-Copper is packaged in closed, sealed drums, 500 lbs. to 850 lbs., (227 kg to 386 kg), with desiccants to control moisture. Once opened, Phosphorus-Copper can react with moisture, and its surface will turn a pasty blue-green. **If your Phosphorus-Copper has a pasty blue-green surface, do not add the Phosphorus-Copper to molten material. Consult your Milward Alloys representative before use.**

Shipping

Phosphorus-Copper is available in stock for fast shipment. Most domestic (USA) orders are shipped within 24 hours to one week. International orders are shipped within one-to-two weeks. At the customer's request, products will be shipped by truck, boat or rail. Our staff will work with you to meet your specifications and needs, discuss options, costs or answer any other questions and concerns.

Supplier of World Class Master Alloys Since 1948

Milward Alloys, Inc., is a manufacturer of hardeners, grain refiners, modifiers and deoxidants for the aluminum and copper melting industries. Milward's master alloys are precisely combined, melted, and packaged additives, made of primary metals and chemicals, designed to satisfy contemporary metallurgical needs.

As a world-class supplier of aluminum- and copper-based master alloys and additives, Milward recognizes that it is of primary importance to anticipate and fulfill the needs of its customers...and to continuously improve by integrating quality, innovation and excellence into our processes, products, service and technology.

Product Line & Custom Capabilities

In addition to the Phosphorus-Copper alloys presented herein, Milward produces other precision alloying additives. For free literature and more information, request the specific bulletins below or visit our website (www.Milward.com).

Aluminum & Copper Master Alloys

- Aluminum master alloys for use as grain refiners, modifiers or hardeners.
- Beryllium-aluminum alloys for control of melt oxidation.
- Copper master alloys for use as deoxidants, alloying agents, wetting agents or hardeners.
- Precision Addition™ family of extruded aluminum master alloys.

Custom & Non-Standard Alloy Products

- Technical support in the metallurgical and chemical design of alloys.
- Testing of the metallurgical and chemical composition.
- Prototyping in semi-finished billets or slabs and DC cast semis.
- Full production runs.
- Non-Disclosure Agreements (NDA).
- Wide range of applications - nuclear shielding, ultra-high purity aluminum for marine and aerospace, exotic welding alloys, special alloys for automotive and aerospace, peculiar alloys incorporating curiosity elements, and other specialized functions.

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Milward Alloys, Inc.
500 Mill Street • Lockport, NY 14094-1712 USA
Phone: 716-434-5536
Fax: 716-434-3257 • Toll-Free: 1-800-833-6600
E-Mail: milward@milward.com • www.Milward.com

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