



COPPER

High performance products and services

VESUVIUS





“Our range of specialised products for the melting and casting of copper based alloys is the widest in the industry.”

Melt treatment

for copper alloys

Copper foundries are highly specialised companies that deal with many different types of castings and alloys. To acknowledge this diversity, Foseco have developed a wide range of products for the melting and casting of copper based alloys and for mould and core making.

All Foseco products are supported by a team of technical experts who can advise and help you to develop an optimised process.

Melt treatment

The main types of alloys requiring melt treatment are high conductivity copper, commercial copper, brasses, gunmetals, aluminium bronzes and copper nickels.

The melting of bronzes and copper based alloys presents special problems. Molten copper dissolves both oxygen and hydrogen and on solidification, the oxygen and hydrogen can combine to form water vapour (steam reaction) which causes porosity in the casting.

Without the presence of oxygen, hydrogen alone may also cause gas porosity. Alloys containing aluminium form oxide skins which can cause problems in castings. In some other alloys, traces of aluminium may cause defects and residual aluminium must be removed.

Special melting and melt treatment techniques have been developed to deal with these effects. These include fluxing, degassing and deoxidation treatments.

Fluxes

Different types of fluxes are available for cleaning, covering, element removal, protection against chromium loss and slag coagulation.

They are sold under the brand names ALBRAL, CHROMBRAL, CUPREX*, CUPRIT*, ELEKTRO, ELIMINALU, RECUPEX and SLAX.

The choice of flux depends on alloy types and foundry practice (furnaces, melt process, type of castings, etc.). There are two melting techniques. One method is to melt the alloy under cover of a reducing flux, which protects the metal from the absorption of oxygen. The second method is to melt the alloy under strongly oxidising conditions using an oxidising flux cover to exclude all hydrogen.

It is frequently necessary to protect the surface of a melt in the furnace or ladle to prevent oxidation losses of alloying elements (such as aluminium or zinc) and gas pick-up from the atmosphere or from the combustion of fuels. ALBRAL and CUPRIT fluxes are recommended for this process.

When it is necessary to melt under oxidising conditions, oxidising fluxes or combined covering and oxidising fluxes are available, such as CUPREX.

Fluxes are also required in scrap recovery. When dirty or oxidised scrap is used, it is essential to eliminate as much non-metallic material from the melt as possible

and prevent loss of metal in the dross. It is also frequently necessary to recover metal from dross. In these cases RECUPEX or fluxes are used.

ELIMINALU 8 is specifically designed to reduce aluminium to a very low level. This flux preferentially reacts with it to form compounds which separate easily by floatation. After the removal of aluminium the flux will act further to reduce silicon and manganese as required.

- + Elimination of gas porosity
- + Elimination of oxides
- + Removal of metallic impurities
- + Effective slag removal

Degassing

LOGAS 50 degassing agent is designed to remove dissolved hydrogen from copper and copper alloys. It also purges and removes oxides from the melt. FDU rotary degassing units can be an alternative. They are particularly effective for removing hydrogen and inclusions from copper melts.

Deoxidants

DEOX Tubes are designed to remove dissolved oxygen from liquid metal by the introduction of a very reactive agent to form a stable oxide which separates from the melt. DEOX Tubes are available for all types of copper-based alloys. Thermal and electrical conductivity of the alloys are not affected.



Fluxes for efficient melt treatment



LOGAS 50 degassing agents and DEOX Tubes for degassing and deoxidation



FDU for degassing



Melting, holding and molten metal transfer

in copper foundries

MELTING AND HOLDING FURNACES

Crucibles

The very widely used method of melting copper in foundries is with crucible furnaces. Gas, oil-fired or induction furnaces are the most common crucible furnaces used in copper foundries. Foseco offers a complete range of crucibles for all of these furnaces.

Coreless induction melting

High alumina dry linings are normally used for copper melting applications, however, silica linings are considered most suitable for brass alloys.

KELLUNDITE* 400 is a high alumina based dry-vibratable refractory especially developed for lining coreless induction furnaces melting nearly all copper-based alloys.

Based on fused alumina, KELLUNDITE 400 with carefully selected additives helps to reduce metal penetration, erosion for enhanced performance and clean furnace operation. SILCOR* 308 is a high purity silica based dry-vibratable refractory for lining induction furnaces melting brass alloys; enriched with fused silica, SILCOR 308 offers improved lining performance.

Capping and spout material

BLU-RAM* HS, BLU-RAM HSW and DURACRETE* RBG are alumina based, ready to use phosphate

bonded plastics and mouldable refractories with alumina content ranging between 45 and 85%.

The benefits of this range are:

- + easy to install
- + low moisture
- + excellent adherence to existing linings

Patch repair and maintenance

X9-PLASTER is a high alumina, high performance plaster with a very fine grain size. DURACRETE 85PC is a cost effective phosphate bonded high alumina putty.

Coil protection

COILCOTE is a high alumina grout that provides a strong protective semi-permanent refractory screed to the power coil.

Slip plane material

FLEXIBLE MICA and COMBI MICA.

Lid material

CERCAST 1500 is a medium weight castable with good volume stability.

Channel furnaces and metal transfer

Channel furnaces are lined with bricks or a low cement castable such as ONYX*. ONYX is an alumina based refractory with additions of silicon-carbide up to 80% to significantly improve the non-wetting characteristics and furnace performance.

In addition ONYX is supplied as

- + Ultra low-cement castable and self-flowing castable
- + Granular ramming mix, plastic mouldable or gunning grades

Channel furnaces inductor and inductor boxes

KELLUNDITE 359 is a high alumina dry-vibratable refractory lining with a silicon carbide addition to increase performance and reduce metal penetration.

MOLTEN METAL TRANSFER

Foseco offers a range of linings for the handling and transport of molten copper alloys.

ONYX 15SF

ONYX 15SF is a low cement castable, alumina based (75% Al_2O_3) with 15% silicon carbide.

The main advantages of ONYX 15SF are:

- + Slag and abrasion resistance
- + Long lining life
- + Pouring characteristic with self-flowing technology

KALTEK* insulating ladle lining systems are a portfolio of one-piece linings, board systems and castable powders.

KALTEK Shanks

The KALTEK Shank system is ideally suited for application in the transfer and pouring of molten copper alloys.

KALTEK Shank linings are available for ladles of up to 1000 kg capacity. The lining is simply inserted into the ladle shell and the gap is filled with a suitably coarse material.

KALTEK Boards

They are supplied in board form. The lining is prefabricated outside of the ladle and then positioned inside.

KALTEK ISO

The KALTEK ISO lining system is supplied as a dry, castable powder. The powder is poured between the ladle shell and a custom-designed former. The powder is heated to initiate a bonding reaction. After a short reaction time, the ladle is ready for use; no water is required. KALTEK ISO linings are suitable for a wide range of ladle capacities.

The advantages of KALTEK ladle lining systems are:

- + Excellent insulating properties
- + Improved molten metal temperature control
- + Reduced labour cost
- + Lower energy cost
- + Safer and cleaner working environment
- + Improved metallurgical properties



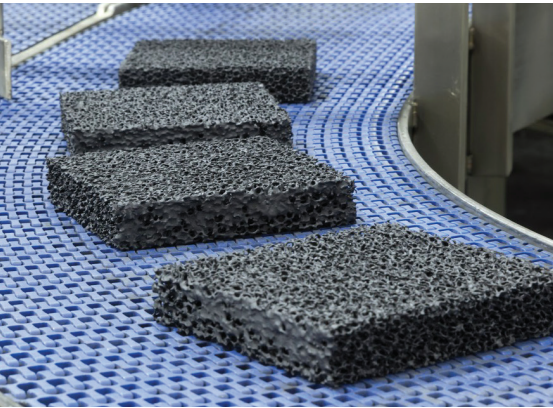
BLU-RAM HS ready to use lining



Coreless induction furnace lined with KELLUNDITE 400



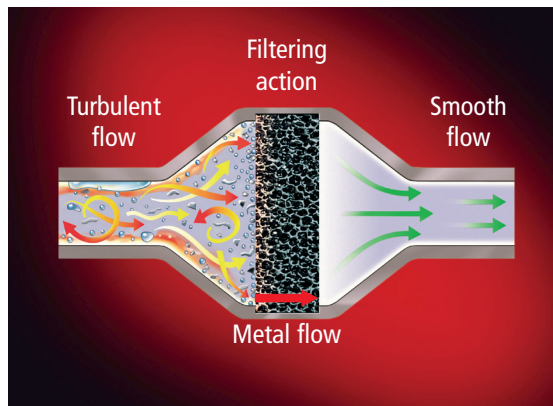
KALTEK Shank system



Manufacturing of SEDEX filters



Our team of application engineers provides solutions to solve foundry production problems



Filtration principle

Filtration

for copper alloy castings

Many castings are highly polished or machined as well as being pressure tested. Therefore inclusions and oxides are very damaging to quality. In order to remove these inclusions and oxides, the use of filters is recommended.

SEDEX* Filters

SEDEX foam filters are a range of multidimensional filters. The metal must flow through a tortuous path before it enters the casting cavity.

Firstly, coarse inclusions, too large to enter the passageways are trapped on the surface of the filter. As inclusions begin to accumulate on the filter surface, a "cake" of material is formed which then permits retention of some finer particles. Molten metal that flows past the filter cake and into the passageways follows a tortuous path through the body of the filter. The foam filtration mechanism is based on multiple changes in metal flow direction and reduction of flow speed, causing smaller particles to be trapped in the internal filter structure.

Finally, foam filters help to prevent the formation of reoxidation inclusions by promoting non-turbulent flow as the molten metal enters the casting cavity. Depending on the alloy and the application, many of the following benefits are achievable with SEDEX filters:

- + Reject control
- + Productivity improvements
- + Casting quality improvements

STELEX* Filters

STELEX ZR filters are particularly suited for aggressive metals like beryllium copper alloys.

To avoid shrinkage porosity, it is necessary to ensure that there is a sufficient supply of additional molten metal, as the casting is solidifying, to fill the cavities. This is known as "feeding the casting" and the reservoir that supplies the feed metal is known as a feeder, feeder head or a riser. The feeder must be designed so that the feed metal is liquid at the time it is needed, which means that the feeder must freeze later than the casting itself. The feeder must also contain sufficient volume of liquid metal, at the time it is required, to satisfy the shrinkage demands of the casting. Finally, since liquid metal from the feeder cannot reach for an indefinite distance into the casting, it follows that one feeder may only be capable of feeding part of the whole casting. The feeding distance must therefore be calculated to determine the number of feeders required to feed any given casting.

The application of the theory of heat transfer and solidification allows the calculation of minimum feeder dimensions for castings, which ensures sound castings and optimum metal utilisation.

There are three basic types of sleeves: insulating, exothermic-insulating and highly exothermic.

Feeding systems

for copper alloy castings

KALMIN*

KALMIN lightweight feeder sleeves are general purpose insulating sleeves for use in copper casting. They are especially suited to applications where exothermic reactions create metallurgical problems, gas defects and other reaction problems. KALMIN sleeves do not contaminate molten metal or sand systems and can be easily removed to leave a smooth surface. KALMIN sleeves are available in several recipes and selection is made depending upon the particular application (KALMIN S, KALMIN 50, KALMIN 60).

KALMINEX*

KALMINEX 2000 sleeves are accurately formed, highly exothermic and insulating shapes suitable for feeding heavy metal castings. They are available as open or blind sleeves with the diameter range of 35-120 mm. Ideally applied via the insert method, the high strength of KALMINEX 2000 sleeves means that they can also be used for ram-up applications. The benefits of KALMINEX 2000 sleeves include:

- + The exothermic reaction and high insulation factor ensure that feeder volumes are minimised, substantially improving yield
- + Fettling costs are strongly reduced, especially where breaker cores are used
- + Isolated sections can be adequately fed, reducing the need for expensive padding

KALPUR*

The KALPUR direct pour process combines the benefits of feeder sleeves and filters. It is suitable for hand-moulded castings and both horizontal and vertical automatic moulding lines. The KALPUR process entirely eliminates the need for a conventional running system. In addition, by allowing the foundryman to pour directly into the casting, directional solidification is improved. The use of KALPUR direct pour technology provides the foundryman with the quality advantages of metal filtration, whilst at the same time offering significant cost and productivity improvements including:

- + Higher yield from the elimination of running systems and hence a reduced metal requirement
- + More room on the pattern plate for further castings or reduction in mould box size
- + Enhanced directional solidification
- + Less scrap in-house and or customer rejects
- + Reduced fettling and cleaning
- + Reduced welding and repair
- + Improved surface finish
- + Better machinability

FEEDEX*

FEEDEX HD are made from low-fluoride, highly exothermic, high-strength feeder sleeve material suitable for copper castings.

Anti-piping compounds

FEEDOL* exothermic powders are used as anti-piping compounds to improve feeding efficiency. They are applied to the surface of risers on copper base castings to reduce heat loss to the atmosphere and extend solidification time.



Foseco sleeves range



Casting made with Foseco sleeves



Methoding advice



Coatings

for copper alloy castings

The choice of coating will depend on the type of moulding material used, the alloy being cast, casting dimensions, weight and component part requirements.

To comply with all these different requirements Foseco have developed a wide range of coating products in which:

Waterbased DYCOTE* products are used for permanent moulds.

RHEOTEC* or SEMCO* water based coatings are suitable for moulds and cores made from all types of foundry binder systems.”

ISOMOL* or TENO* alcohol-based coatings are designed for moulds and cores which do not require drying.

A range of specialist coatings is also available to help resolve demanding problems.

DYCOTE

DYCOTE permanent mould coatings are blends of insulating and lubricating refractory materials with silicate binders. They are formulated to meet a wide variety of performance and production requirements such as insulation, durability, surface texture, and lubricity.

Supplied in a concentrated liquid or paste-like form, DYCOTE permanent mould coatings are easily diluted with water to provide the consistency required by individual foundries.

Foseco’s DYCOTE die dressings are suitable for gravity and low pressure diecasting of copper alloys. They are designed to:

- + Provide good insulation control
- + Facilitate easy release of the casting from the die
- + Encourage the filling of thin sections
- + Ensure good casting finish
- + Protect the surface of the die ensuring longer die life

DYCOTE coatings can either be applied by means of a spray gun onto the warm die or the die or core is dipped into the diluted coating.

Water based coatings
SEMCO/RHEOTEC

SEMCO and RHEOTEC products are water-based coatings with a full range of application rheologies and refractory combinations that offer superior performance for individual foundry requirements.

TERRAPAIN

TERRAPAIN coatings are a range of water-based products for dilution and use on sand moulds and cores.

Solvent based coatings
TENO/ISOMOL

TENO and ISOMOL products are alcohol-based coatings with a full range of application rheologies and refractory combinations that offer superior performance for individual foundry requirements.

MOLDCOTE*/MOLCO

A comprehensive range of flash-drying and air-drying coatings for use on sand moulds and cores in the casting of copper alloys.

Speciality coatings
CHILCOTE

CHILCOTE 8 coating is supplied ready-for-use and is recommended for coating external chills or chill moulds. It is especially recommended for phosphor bronze stick moulds and for coating metal cores used in chill cast cored billet production.

FRACTON

A range of pastes and liquids for protection of troughs, refractory surfaces, metal dies, launders and other metal tools from attack by molten metal.

HOLCOTE*

HOLCOTE 110 coating is a zircon containing water based, fully thixotropic dressing, ideally suited to the coating of refractory launder systems used to transfer molten copper.

SPUNCOTE

Specialist products formulated to provide a permeable coating with very low gas evolution for the centrifugal casting process. They can also assist metal flow and promote easier stripping of the finished casting.

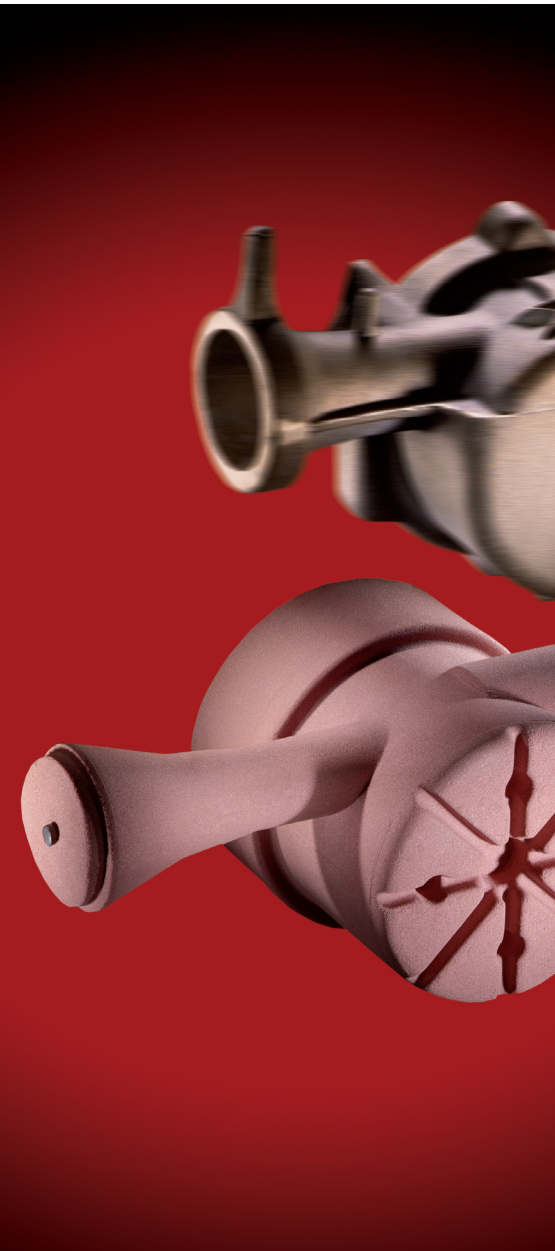
Our international application experts will help you to find customised solutions



Brush coating designed to improve surface finish



Coatings are produced in our ISO 14001 accredited plants



Binders

for copper alloy castings

Foseco offer a broad range of products for the production of resin and silicate bonded moulds and cores suitable for all copper based foundries.

Self-setting resin systems

ESHANOL*/FUROTEC

Foseco's ESHANOL and FUROTEC resin systems are a range of furane binders and liquid catalysts suitable for the production of moulds and cores that offer the following benefits:

- + Minimisation of hot tearing defects
- + Low addition rates
- + Reclaimability
- + Low fume

FENOTEC*

The FENOTEC system uses an alkaline phenolic resin binder cured with an organic liquid ester. A range of liquid hardeners is available designed to cater for a wide range of setting times. Suitable for the production of both moulds and cores, FENOTEC resin binders can be used on a wide range of castings in a wide range of alloys and used sand is suitable for reclamation after casting.

- + Ideally suited to high speed continuous mixers
- + Good mould strengths can be achieved at low addition rates
- + Negligible mixing fumes
- + Low odour on casting and knock-out
- + Excellent surface finish
- + No nitrogen, sulphur or phosphorus related defects

POLISET

POLISET binders are a two part polyurethane no-bake resin system comprising of a liquid phenol/formaldehyde resin and a liquid polyisocyanate including a hardener.

One of the main benefits of the POLISET system is the degree of work-time which is available as a percentage of the strip-time (typically 60-80%).

POLISET binders provide excellent post casting breakdown, which can help to eliminate hot tearing defects and can be used with high levels of reclaimed sand.

DUOMIX

The DUOMIX no-bake resin control system optimises resin and hardener additions enabling the foundry to maintain process control and improve binder usage economies.

Gas-set resin systems Polyurethane coldbox

The POLITEC* system is a two part polyurethane coldbox binder process for the mass production of sand cores. In addition, a wide range of amine catalysts are available.

Silicates

Recent health and safety guidelines and increasing environmental legislation has led to a renaissance of this inorganic and odourless class of foundry binding agent. Foseco produces a broad range of silicate binders for the production of both moulds and cores using both CO₂ and CARSET liquid ester catalysts. The benefits of Foseco's CARSIL sodium silicate systems include:

- + Less toxic than conventional resin binder systems
- + No nitrogen, sulphur or phosphorus content
- + High resistance to hot tearing
- + Low viscosity
- + Good compactability
- + Excellent breakdown characteristics

Parting agents

Parting agents for self-setting and gas-setting processes are available in liquid, powder and spray form.

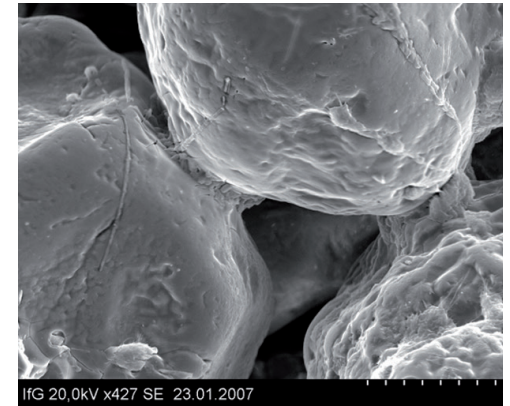
Glues and sealants

Adhesives

- + CORFIX* heat setting or cold bonding core adhesives

Sealant and mould and core repair compounds

- + CORSEAL sealants for jointing all types of core materials and for minor core repairs
- + TAK sealants for mould and core joints



SEM photo of silicate bonded sand



CARSIL resin bonded sand mould



Customer application support

Quality, consistency and flexibility

Research and development

As the quality demands from end-users of castings increases, it is essential that foundry technology keeps pace. Foseco continually invest resources in the research and development of innovative solutions to the problems of today and tomorrow. Development laboratories work closely with in-house casting facilities to ensure new product developments fully meet the customer's needs.

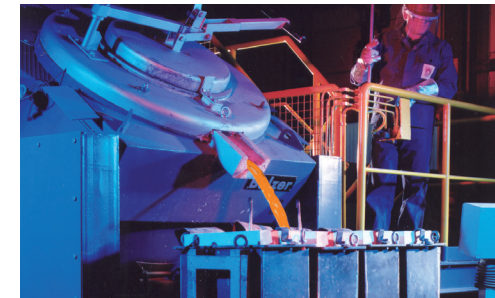
Consistency

Controlled and automated manufacturing processes ensure that products are supplied to a highly consistent specification, minimising batch to batch product variations.

Quality assurance

Accredited quality assurance systems ensure optimal testing of finished product, and provides a framework for continual improvement and further process optimisation.

Strength testing
of SEDEX and
STELEX filters



Coating
measurement



Wet layer
coating thickness
measurement



FOSECO. YOUR PARTNER TO BUILD ON.

*FOSECO, the Logo, BLU-RAM, CORFIX, CUPREX, CUPRIT, DURACRETE, DYCOTE, ESHANOL, FEEDEX, FEEDOL, FENOTEC, HOLCOTE, ISOMOL, KALMIN, KALMINEX, KALPUR, KALTEK, KELLUNDITE, MOLDCOTE, POLITEC, RHEOTEC, SEDEX, SEMCO, SILCOR; STELEX and TENO are trade marks of the Vesuvius Group, registered in certain countries, used under licence. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system of any nature or transmitted in any form or by any means, including photocopying and recording, without the written permission of the copyright holder or as expressly permitted by law. Applications for permission shall be made to the publisher at the address mentioned.

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