IRT M2P

Institut de Recherche Technologique

Matériaux Métallurgie et Procédés

ADVANCED FOUNDRY

Recycling, melting and casting high quality metals

Improving liquid metal processes is fundamental to increase the performance of metallic products while decreasing their environmental impact. IRT M2P works on multiple aspects of liquid metallurgy and pyrometallurgy: melting and casting under a protective atmosphere of recycled materials and new alloys while maintaining high purity ; analysis and characterization of as-cast semi-products ; various forming techniques such as forging, rolling and also gas atomization ; near-net-shape processes in order to reduce material consumption.
Through an improved understanding at semi-industrial scale of the links between process parameters and product properties, industry can deploy new and improved materials and processes more quickly and efficiently.

EXPERTISE & SERVICES

Improving the recycling of metallic materials
- Link between scrap properties and as-cast metal quality
- Development of pyrometallurgical recycling processes that maintain metal quality

Melting, casting and atomization of any alloy under a protective atmosphere to ensure quality: Al, Fe, Ni, Cu, superalloys and reactive or refractory metals (Ti, Nb, Ta, etc.)
- Chemical analysis during melting
- Liquid metal/slag equilibrium measurements
- Studies on the kinetics of inclusion dissolution, metal cleanliness and inclusion/fatigue relationships

Wide variety of casting platforms: ingot, near-net-shape by sand or investment casting

Refractory/liquid metal corrosion studies

Access to various forming techniques such as forging, thixoforging, rolling or gas atomization

Small series or prototype production

Technical support for evaluating the industrial relevance of new melting and forming techniques

Analysis and characterization of liquid metal, as-cast or formed products and final products

TECHNOLOGY

Induction melting
- Melting under vacuum or protective atmosphere in refractory or cold-hearth crucibles
- Various semi-products: ingots, bars and complex shapes including near-net-shape
- Sensors in the furnace and moulds for data collection and modeling
- High purity and low inclusion metals

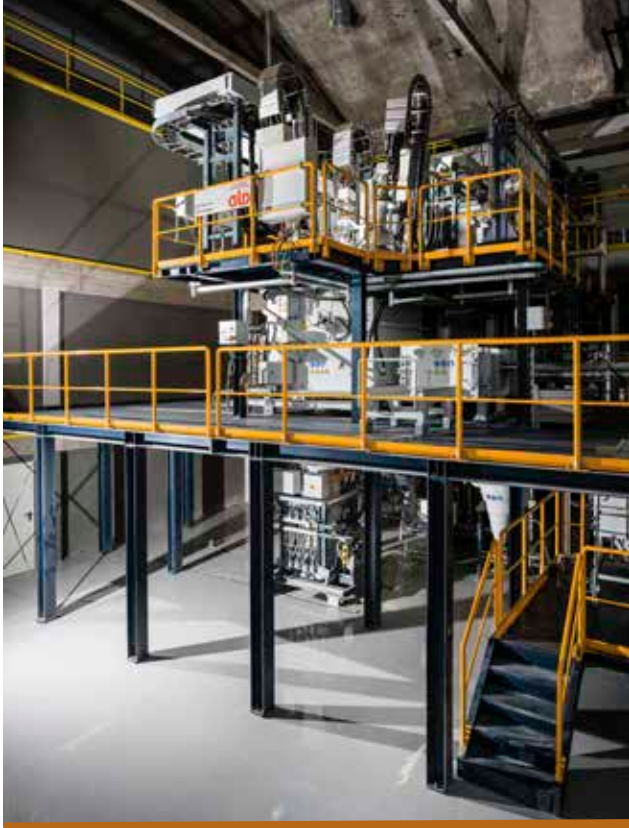
Plasma arc melting
- Cold-hearth refiner for melting/remelting refractory or reactive metals
- Multi-parts crucible in order to better eliminate inclusions and improve final ingot cleanliness
- Controlled atmosphere melting (He or Ar) at near-atmospheric pressure in order to avoid evaporation of volatile alloying elements and better control final chemistry
- Flexible charging system that allows the remelting or recycling of ingots, various revert/turnings, virgin raw materials and/or metallic powders

Chemical analysis and physical characterization

Simulation
- Artificial intelligence to automatically identify metallic phases and microstructures
- Our furnaces are equipped with multiple sensors that can feed into and/or validate numerical simulations
- Metal/slag equilibrium measurements generate critical and difficult to obtain data for thermodynamic models

APPLICATIONS

- New alloy development:
  Support for the industrialization of new alloys via pilot-scale melts
  Pre-series and prototype production
  Semi-industrial scale trials to optimize process parameters
- Recycling:
  Participation in the creation of a French recycling structure for aerospace grade titanium
  Evaluation of recycled materials characteristics and quality
  Melting tests to validate the compatibility of recycled materials with metal quality specifications
- Production of ingots/electrodes for gas atomization
- Participation in the development of a numerical model for PAM-CHR furnaces
- Development of new and innovative melting and forming processes such as thixoforging
- Principal markets: aerospace (engine parts), medical (implants), energy (nuclear, hydrogen, oil&gas), defence (marine, armory), transportation (automobile parts, motorsports, rail/train)



EQUIPMENT @M2P

VIM (Vacuum induction melter)
- 10 - 50 L melting capacity (20-400 kg depending on alloy)
- Alloys: Fe, Al, Ni, Cu, Co, etc.
- Refractory crucible
- Ingot, sand mould and investment casting
- Mould preheating and post-casting heat treatment

PAM-CHR (Plasma arc melter, cold-hearth refiner)
- 70 - 150 kg ingots: 10 or 15 cm Ø x 150 cm length
- Alloys: Ti, TiAl, Nb, reactive/refractory
- Raw materials: revert, turnings, powder, bars, virgin raw materials

ISM (Cold crucible induction melter)
- 0,9 L water cooled copper sectored crucible
- Rapid sampling machine
- Alloys: Fe, Ni, Ti, Zr, etc.

CHARACTERIZATION
- Chemical analysis of liquid or solid metal by optical emission spectroscopy (OES, arcspark), X-ray fluorescence (XRF-WDX) or wet chemistry (ICP)
- Oxygen activity measurement of liquid metal
- Dissolved gas analysis: ONH, CS
- Metallographic characterization (optical, SEM)

Further information on our activities www.irt-m2p.fr

RELATED ACTIVITIES

LIFE CYCLE ASSESSMENT & RECYCLING

Increasing the quantity of recycled materials in metallurgical processes should not come with a decrease in quality. Following LCA and recycling analysis, candidate materials can be tested in our semi-industrial scale furnaces in order to determine any impact on quality and how to avoid it.

METAL POWDERS

Our advanced foundry platform is equipped to produce any alloy - including those not yet available on the market – as feedstock for our atomizers. Our furnaces also bring the circular economy to powder metallurgy by producing ingots from recycled materials and even remelting unused powders.

About IRT M2P

The Institute of Research and Technology for Materials, Metallurgy & Processes (IRT M2P) is your partner for developing innovative products and processes to accelerate your company's growth.

We bring our expertise, a wide array of state-of-the-art semi-industrial technological platforms and a network of academic labs to the R&D projects we carry out with our more than 120 industrial partners.

Contact us to discover our 9 areas of technological expertise:

> Advanced Foundry
> Life Cycle Assessment & Recycling
> Metal Powders
> Surface Treatment & Coatings
> Mechanical Surface Treatment
> Heat & Thermochemical Treatment
> Composite Materials
> Multimaterials Joining
> Analysis & Characterization

Working together

- Multi-partner research projects with private/public co-funding
- Private research studies, tailor-made services
- Small series & prototype production
- Training

IRT M2P

Institut de Recherche Technologique
Matériaux Métallurgie et Procédés

Melting & Forming Platform
109, rue de Thionville
F-57270 UCKANGE

Headquarters
4, rue Augustin Fresnel
F-57070 METZ
+33(0)3 72 39 50 85
contact@irt-m2p.fr

www.irt-m2p.fr