

**SPIRE
Pre-Brokerage
event**

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***CLOSE-LOOP PRODUCTION OF
REACTIVE POWDERS FOR ADDITIVE
MANUFACTURING & PM***

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IRT M2P - Institut de Recherche Technologique Matériaux Métallurgie Procédés



- a **Technological Research Institute** devoted to materials, i.e. metals, polymers and composites
- created in **2013**, thus still growing and developing (70+ people)
- based in the East of France, main office and labs in Metz
- one of the strengths of IRT M2P is in the **combination of materials**, analyzed from different standpoints, including technologies for joining & coating materials and end-of-life treatments
- regarding **Processes**, IRT-M2P is interested in the following themes, with a focus on the Circular Economy:
 - **LCA** – the challenge is to use LCA (extended to economic and social dimensions, but beyond LCC & SLA) for a combination of materials, i.e. real-life artifacts & goods
 - **MFA** – the emphasis is on foresight, balancing the flow of primary & secondary raw materials and integrating intermaterial competition and cooperation
 - (practical) **Recycling** of materials – how to recover major and minor materials from commercial goods, more efficiently than is done today?
 - participation to the development of **emerging production technologies**, like additive manufacturing, etc.

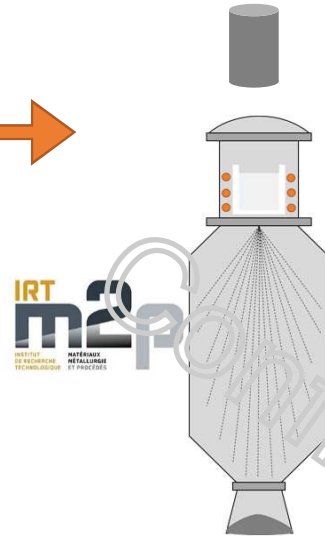
Project concept

Alloy Formulation



CLOSE-LOOP PRODUCTION OF REACTIVE POWDERS FOR ADDITIVE MANUFACTURING & PM

Goal : Recycling 100% of non-melted powder



Goal : Recycling 100 % of Fine Powder

Fine particles 25 %

Atomization Optimization
Goal : Yield 75%
Powder characterization

Additive Manufacturing

A vertical stack of logos for partner institutions: KATHOLIEKE UNIVERSITEIT LEUVEN, ZODIAC AEROSPACE, LIEBHERR, THALES, SAFRAN, and AIRBUS SAFRAN LAUNCHERS.

Functional qualification

Project concept

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- the project focuses on **new process technology** (additive manufacturing), which was not explicitly included in the SPIRE roadmap
- **production of powders** and creation of a close-loop/open loop process route (**recycling of process "scrap"**, i.e. non-used, non-melted powder), cutting across the value chain and thus akin to **industrial symbiosis**, focusing on **material efficiency** but also **energy efficiency**
- the design of the close-loop process is done at the same time as the technology is developed, not afterwards!
- **potential for integrating other process scrap**, generated by negative manufacturing, which will continue to co-exist with additive manufacturing
- **potential for handling other materials**, including non-metal, which are also moving into additive manufacturing, sometimes at very large scales
- therefore, it is a **very open and powerful concept!**

EXPECTED IMPACT

**CLOSE-LOOP PRODUCTION OF
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- **Call topic:**
 - SPIRE 09-2020: Making the most of mineral waste, by-products and recycled material as feed for high volume production (IA)
 - SPIRE 01-2020: Industrial symbiosis (IA)
- **SPIRE roadmap**
 - KA 4.4: Value chain collection and interaction, reuse and recycle schemes and business models
 - KA 2.5: New energy and resource management concepts (including industrial symbiosis)
 - KA 3.2: New processes for energy and resource efficient materials applied in sectors down the value chain
- **Cross-sectorial characteristics of the idea**
 - metals, from steel to aluminum, titanium, etc. (Mg)
 - potentially extendable to other non-metal materials (concrete, ceramics, polymers, elastomers, composites, etc.)

EXPECTED IMPACT

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- **General comments**
 - the roadmap and the calls, which are based on it, is now more than 5 years old.
 - technology, society, the economy have changed and breakthrough technologies have become credible
 - some of them, like Additive Manufacturing, also belong to the Process Industries and, as such, ought to join the SPIRE family of calls
- **Expected Impact:**
 - these are new processes, but addressing the same family of materials and substances that are the core of SPIRE
 - issues are energy & material efficiency as well as societal integration (as quickly as possible)
 - existing technology research on new processes does not deal with their "practical" dimensions, which "belong" to SPIRE
- **Difficulties:**
 - the level of the call (here IA) may not fit the innovative dimensions in terms of new processes: RIA would fit better!
 - **rewriting of the call at the margin?**

EXISTING PROJECT CONSO

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Confidential

LOOKING FOR PARTNERS

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- *Present partners include aluminum and titanium as well as the aerospace industry*
- Looking for partners in other metals, other materials
- ... and in other sectors seriously involved in the development of additive manufacturing

CONTACT DETAILS

**CLOSE-LOOP PRODUCTION OF
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The 6 Key Components have been broken down into 21 essential and complementary Key Actions (KA):

1. Key Component FEED

- **KA 1.1:** Enhancing the availability and quality of existing resources
- **KA 1.2:** Optimal valorisation of waste, residue streams and recycled end-of-life materials as feed
- **KA 1.3:** Optimal and integrated (re) use of water
- **KA 1.4:** Advancing the role of sustainable biomass/ renewables as industrial raw material

2. Key Component PROCESS

- **KA 2.1:** Novel advanced energy technologies
- **KA 2.2:** Energy harvesting, storage and reuse
- **KA 2.3:** Process monitoring, control and optimization
- **KA 2.4:** More efficient systems and equipment
- **KA 2.5:** New energy and resource management concepts (including industrial symbiosis)

3. Key Component APPLICATIONS

- **KA 3.1:** New materials contributing to development of energy and resource efficient processes
- **KA 3.2:** New processes for energy and resource efficient materials applied in sectors down the value chain

4. Key Component WASTE2RESOURCE

- **KA 4.1:** Systems approach: understanding the value of waste streams
- **KA 4.2:** Technologies for separation, extraction, sorting and harvesting of gaseous, liquids and solid waste streams
- **KA 4.3:** Technologies for (pre)treatment of process and waste streams (gaseous, liquids, solids) for re-use and recycling
- **KA 4.4:** Value chain collection and interaction, reuse and recycle schemes and business models

5. Key Component HORIZONTAL

- **KA 5.1:** Identification, benchmarking and cross-sectorial transfer of good energy and resource efficiency solutions and practices
- **KA 5.2:** Methodologies and tools for cross-sectorial Life Cycle and Cost Assessment as well as novel social Life Cycle Assessment of energy and resource efficiency solutions
- **KA 5.3:** Develop skills and education programmes required for the development and deployment of novel energy and resource efficiency solutions and practices
- **KA 5.4:** Enhancing innovation and entrepreneurial skills and culture

6. Key Component OUTREACH

- **KA 6.1:** Analysis and establishment of efficient technology dissemination methodologies, mechanisms and frameworks
- **KA 6.2:** Develop social responsibility for the process industry

CE-SPIRE	01-2020	Industrial symbiosis (IA)
CE-SPIRE	02-2018	Processing of material feedstock using non-conventional energy sources (IA)
CE-SPIRE	03-2018	Energy and resource flexibility in highly energy intensive industries (IA 50%)
CE-SPIRE	04-2019	Efficient integrated downstream processes (IA)
CE-SPIRE	05-2019	Adaptation to variable feedstock through retrofitting (IA 50%)
CE-SPIRE	06-2019	Digital technologies for improved performance in cognitive production plants (IA)
CE-SPIRE	07-2020	Recovery of industrial water, thermal energy and substances contained therein (IA)
CE-SPIRE	08-2020	Improved Industrial Processing using novel high-temperature resistant materials (RIA)
CE-SPIRE	09-2020	Making the most of mineral waste, by-products and recycled material as feed for high volume production (IA)
CE-SPIRE	10-2018	Efficient recycling processes for plastic containing materials (IA)