IoT as an enabler for Circular Manufacturing:
self-symbiosis in Zinc Alloy production

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Industrial Pilot in Zinc Alloy Production

- Foundry specialised in zinc alloys production for die casting.
- Over 60 years of industrial experience
- ~50 employees
- ~45M€ revenues
- 3 production lines

Continuous improvement thanks to investments and experiments towards the sustainability of the entire production cycle following the EU Green Deal lighthouse and Circular Economy guidelines.

- **100%** Raw materials (SHG zinc, Mozal aluminum, magnesium and copper) zamak scraps and by-products entering the production cycle
- **99.8%** Total waste sent for recycling
- **2.2%** Reduction of CO2 emissions per unit of product
A model of self-symbiosis industry

Die-Castors

Zamak ingots

Secondary raw materials

Liquid metals alloy

Die-castors products

Zamak Producer

60% die-castors by-product or defective products
20% others by-product, end-life materials
20% scraps
Objectives vs Circular Economy Needs

- Innovative IoT platform for continuous monitoring across the whole production process:
  - to identify secondary raw materials qualities and compositions
  - to analyze in real-time alloy chemical characteristics in furnace
  - to reduce energy consumption (e.g. regulation of the fun for powders sucking)
  - to reduce waste and emission
  - healthier human working environment

- a new concept of certification and digital tracking and tracing of secondary raw materials (SRM) though Digital Product Passport of SRM

- Innovative digital zamak alloys design based on AI analysis and simulation to identify the quality of secondary raw materials most suitable to:
  - reducing waste and emission
  - extracting the best formulation to be offered to customers for the production of other object

- to improve collaboration with all stakeholders involved in the product value chain
ZamaSave Production Process - AS IS

Materials Check:
- Visual
- Manual
- Radiometric control
- Chemical Test

Quality ZamaSave?

Production Phase A:
Selection of raw materials (removing unnecessary metals)

Production Phase B:
1. Materials loading – furnace
2. "Pestellatura" (mixing)
3. "Scorifica" (cleaning)

Corrective actions:
Add aluminum, copper and / or magnesium
Add pure zinc

Oven Full?

Tester QC OK?

Claim to supplier

Production Quality C

Production Phase C:
Finished product ZamaSave ready for customer delivery

Product Downgrade
Finished product Quality C ready for customer delivery
Zamasave Production Process – TO BE

Materials Check:
- Visual
- Manual
- Radiometric control
- Chemical Test

Quality ZamaSave?

YES

Production Phase A:
Selection of raw materials (removing unnecessary metals)

Production Phase B:
1. Materials loading – furnace
2. «Pestellatura» (mixing)
3. «Scortifica» (cleaning)
4. Continuous Quality Control

Claim to supplier

Production Quality C

NO

Corrective actions:
Add aluminum, copper and / or magnesium
Add pure zinc

Tester QC OK?

NO

YES

Production Phase C:
Finished product ZamaSave ready for customer delivery
• to introduce an innovative decision support system based on IIoT tools and AI based analysis, able to monitoring
  • production process (criticalities, alert, suggested corrective actions, etc.)
  • energy consumptions
  • the level of waste and emissions
  allowing a rapid reconfiguration of materials compositions

• an AI based decision support system, able to connect the chemical-physical-mechanical characteristics of the ZamaSave alloys to the various die-cast objects made by his customers. This solution will help zamak producers and customers to simulate and test different qualities of raw materials as well as new alloys on a virtual environment (waste reduction of materials used for test)

• a new concept of certification and digital tracking and tracing of secondary raw materials (SRM) though Digital Product Passport of SRM
Expected Impacts

- **Energy**
  - 5% of energy consumption reduction

- **Waste Savings**
  - 10% of waste and emission reduction

- **Market**
  - Innovative zamak alloys based on the quality of secondary raw materials most suitable towards the EU Green Deal objectives

- **Productivity**
  - Production process leadtime reduction
  - 5%-10% production volumes increase

- **Workers well-being**
  - Reduction of powders emission
Thank you!

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