SMARTMELT: A Data-driven Melting Process Optimizer

Our cutomer's problem

Environmental Concern: Worldwide, melting aluminium scraps **costs ca. 12 billion US$/year and produces 50 million tons of CO2**. While average consumption of a state-of-the-art melting furnaces is 750 kWh/ton, but up to 1400 kWh/ton in the US (some furnaces show even higher values), the energy required to melt 1 ton of Al is theoretically only 325 kWh! There is a huge room for improvement.

Operational Issue: melting process is very inefficient because the operation of larges furnaces **is still mainly based on human decisions.** The operational sequences lack of governance and transparency as there is **no tool available to monitor and determine the optimal time sequences and execution,** which are made based on the experience and feelings of the operators.
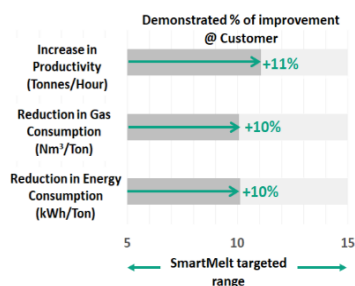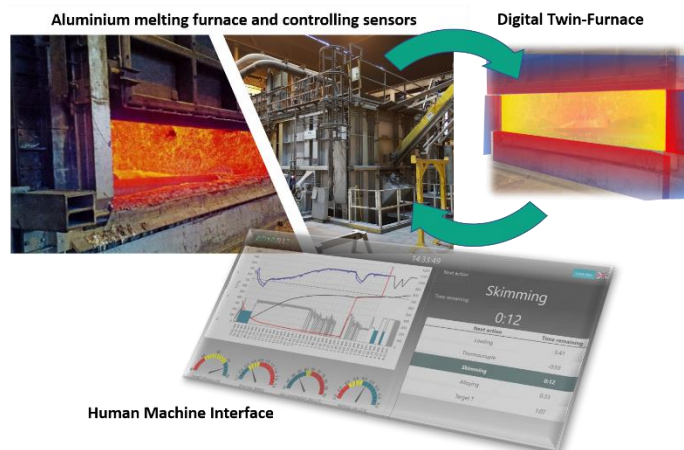
What is SmartMelt?

SmartMelt solution includes a digital-twin furnace which combines very efficient numerical calculations with on-line data acquisition. The model predicts the future state of the system and guide operational sequences while adapting to influences of past events.

Designed to be integrated on any existing industrial furnace, the objective of SmartMelt is to **minimize energy and gas consumption, hence environmental impact, increasing productivity and safety of operators during processing, offering the means for a sustainable process** with potential for further optimization.

Key Features

- **Real-time metal bath temperature, gas and energy consumption**, which are not accessible otherwise.
- **Monitor of the various events** such as door opening, loading, melt skimming, and integration of their influence into the prediction.
- **Quality assurance and process control for sensitive products**

Aluminium melting furnace and controlling sensors

Digital Twin-Furnace

Human Machine Interface

Demonstrated % of improvement @ Customer

Increase in Productivity (Tonnes/Hour) +11%

Reduction in Gas Consumption (Nm³/Ton) +10%

Reduction in Energy Consumption (kWh/Ton) +10%

SmartMelt targeted range

Heart of SmartMelt

The numerical model at the heart of SmartMelt belongs to the category of so-called "reduced models".

In such a model the geometry, structure and materials of the furnace are reproduced, and all the physical phenomena are simplified in order to speed up the computations.

The computation time of a whole melting cycle (typically 4-6 h) is so fast (typically < 1 s) that it allows to retrofit the adjustable parameters **directly on-line by comparison with data coming out of the furnace.**

- Account for **type and morphology of scrapes.**
- **Web oriented interface offering a remote access** for process engineers and supervisors.
- **Statistical analysis** module allowing for data-driven initiatives for continuous improvement.

Customer Benefit

Environmental Impact: The use of SmartMelt has driven a demonstrated **reduction of 10% in energy consumption and CO2 emissions** (target is 5-15%).

Operational Impact: Increase of productivity, quantified in tonnes per hour, of 11% (target is 5-15%). The operators follow the recommendation from SmartMelt to execute standard operations at optimal predicted times.

Customer Feedback: Operational teams **value the friendliness of the interface**. The supervisors are eager to have **a cycle performance report that allows them to assess the run and challenge their teams** accordingly. Mid-management see in **SmartMelt a reliable tool and a bridge towards Industry 4.0** on an area of the production that had very difficult access in the past.

Contact Us!

Novamet is an EPFL spin-off founded by Dr. A. Rostamian and Prof. M. Rappaz. Our team includes highly professional members with several years of successful experience in industrial thermal processes, ad-hoc software development, and digitalization.

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