



# Wishlist For Future Research

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# DISCLAIMER!



The following is a list of recommendations for the future Roadmap within the RFCS

It is intended to be taken as suggestions/guidance for the actions that could extend the capability of European steel research in Casting

**Driver:** There is much emphasis on new digital technologies and intelligent control systems but these are only as good as the hardware that it controls. Throughout Europe steel plants are ageing.

**Suggestion:** Actions capable of addressing the aging of European Steelplants by 1) extending the working life through improved efficiency and 2) production of new grades and/or higher quality specifications with a higher value added on existing production units with none or limited investment.

**Driver:** Modelling and other Digital platforms (e.g. Virtual Reality, Artificial Intelligence, Internet of Things, etc.) are key technologies that must be backed up by real plant and experimental validation as well as adequate data inputs

**Suggestion:** Actions prioritizing research on Digital twins, online metallurgical models, multivariate analysis for correlation with process conditions and Big Data analysis. This includes thermophysical and chemical properties, open-access databases and product quality data accessible to all steelmakers.

Mould powders  
DATABASE

Plant data for  
validation

Thermo-  
mechanical props  
of materials

**Driver:** Techniques and numerical modelling knowledge needs transferring across a broader platform other than stakeholders in RFCS projects. This includes Academia, Industrial Partners (not related to modelling) and decision makers (funding agencies, governments, industrial bodies, etc.) to provide a better understanding of modelling capabilities and limitations to enable its wider application.

**Suggestion:** Actions that attempt breaching the barriers that prevent full exploitation of modelling including complexity, software/hardware availability, licensing costs, skills gap and online implementation. Dissemination actions and education.

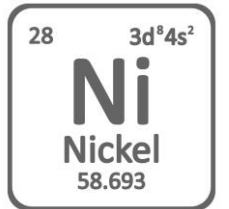
**Driver:** Emphasis on greener steelmaking including a move away from traditional integrated steel plants using the blast furnace route. There will be a higher use of scrap and more Direct Reduced Iron (DRI).

Reduction of CO2 emissions  
 → **Increase the use of scrap**  
 → problem with tramp elements

- Ca and S causing clogging
- Cu / CuS influence on hot ductility

**Suggestion:** Actions capable of addressing challenges arising from Carbon-free and Hydrogen steelmaking, as well as other new steelmaking techniques due to the increase of residual elements which are detrimental to castability and mechanical properties.

**Driver:** The use of alternative alloying elements which are cheaper or more readily available can bring forward their own issues such as mould powder pick up, clogging and negative modification of flux properties.



**Suggestion:** Actions to study the effect of alternative alloying elements for new generation steels from more economical and sustainable sources.

**Driver:** Measurement techniques able to produce tangible savings in yield or improved quality through automated monitoring and inspection of casting conditions/outputs and product quality.

**Suggestion:** Actions to develop sensors capable of process control and product monitoring and/or coupling to AI and other digital technologies to suggest corrective actions to cracking and process problems based on machine status and product quality.





**Driver:** As higher performance steels are created there must be an associated development of casting powders and mould coatings to facilitate casting.

**Suggestion:** Research actions are needed to generate fundamental knowledge on the physiochemical properties of new combinations of flux materials and the interaction between these and new steels. Models which be used to predict these changes need to be further developed. Alternative techniques to allow standard powders to be used in more technically demanding applications.

NEWFLUX

OPTICALHT

INNO SOLID

**Driver:** Casting of advanced steel grades and the utilization of high productivity CC machines (high casting speed, increasing casting formats..) give rise to new defects in as-cast semis and rolled products. These facts together with higher customer requirements decrease the production yield and raise the cost and environmental footprint of the whole steel production process.

**Suggestion:** Actions prioritizing research to increase basic metallurgical knowledge in order to assess the cause of defects in the as cast/rolled product, and to find new casting technologies both to avoid defects and to increase yield.

**Driver:** Near net shape is very important in terms of yield and reduction of waste. However, if there are defects, there is a reduced window for rectification that could mean that more material is scrapped because it cannot be reclaimed or repaired.

**Suggestion:** Actions to improve quality to allow the near net shape savings to be realised by casting with no rectification and processing to final product with less waste by improving quality of cast products with a knock-on effect on energy savings and sustainable production.

**Driver:** Projects which address the gap between theoretical/fundamental knowledge and final implementation.



**Suggestion:** These solutions must be able to transfer technologies for the benefit of European industry enabling clear implementation routes for a wider number of stakeholders, or in the case that only one stakeholder is benefited, it should produce a significant step beyond state of art by application of breakthrough technologies or concepts with a clear path for development across several TRL steps.

## Drivers:

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With the current climate going forward we foresee that there will be a greater interest in on-line content:

- Webinars are excellent tools for dissemination.
- They offer the target audience significantly reduced investment in terms of time and travel compared to live events.
- Attend for a part of the day without greatly impacting on the day to day operation.
- Potentially allowing more attendees from a plant representing a greater spread of expertise and interest.

There has been a very positive response to the VALCRA on-line webinars reaching far beyond the numbers that we originally estimated.

We have found a number of attendees from universities. Providing a potential closer link between industry and academia. Students find it difficult to finance attendance of large scale conferences.

## Suggestions:

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- EU could organise an annual on-line dissemination workshop to present all of that years' RFCS final reports linked with the publication of final project reports.
- In a similar way to the VALCRA webinars, these events could also be recorded and kept as an online open access tool.
- Provide an easily accessible, widely distributed forum which allows stakeholders to access up to date and emergent technologies funded by EU projects.



Thank you for your attention.

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