10 PhD positions in the EU Horizon Europe Marie Skłodowska-Curie DN Project: HELIOS (Hydrogen mEtalLurgy In the climate-neutral production Of Steel)

Applications are invited for 10 PhD positions ("Doctoral Candidates - DC") to be funded by the Marie-Skłodowska-Curie Doctoral Network HELIOS within the Horizon Europe Programme of the European Commission. HELIOS is the "Training a New generation of Researchers in adoption of Hydrogen mEtalLurgy In the climate-neutral production Of Steel" project. The HELIOS Doctoral Network will train 10 motivated and talented Doctoral Candidates (DCs) in breakthrough technologies for the hydrogen-based production of green steel, including both carbon steel and stainless steel. These DCs will be equipped with the necessary science capital and diverse transferable skills to pursue their careers in Europe and become the experts that our society needs to achieve the climate-neutral production of steel by 2050. The intersectoral training programme (HELIOS has 4 academic and 1 non-academic Beneficiaries) is dedicated to the technical and economic challenges and innovative developments associated with the transition to hydrogen-based green-steel production. It covers a wide range, from process development, monitoring, engineering and modelling to safety engineering and lifecycle and economic analysis. The combination of state- of-the-art doctoral research projects, intersectoral secondments and supervision by leading companies and universities will be the foundations of HELIOS's success.

Key dates

- 1 June 2023: Launch of 10 DC Positions
- 3 September 2023: Deadline for on-line application
- 15 September 2023: Circulation list "HELIOS pre-selected candidates"
- 12 October 2023: HELIOS Recruitment Event (date subject to confirmation)
- 13 October 2023: Circulation list "selected HELIOS DCs"
- March 2024: Targeted starting date for DC contracts (or earlier, if possible)

Key background info

Number of positions available
10 PhD Positions

Project type
HELIOS is a MSCA DN project (Doctoral Network). Each recruited researcher will be enrolled in a doctoral program in one EU Member States

Research Fields
Process Metallurgy, Thermodynamics, Kinetics, Mineral Processing, Computational Engineering, Plasma Physics, Life Cycle Management

Keywords
High-temperature testing, Sampling and characterization, Modelling and simulations, Machine learning, Environmental/economic assessment, In-situ sensing and measuring

Benefits and salary
The successful candidates will receive an attractive salary in accordance with the MSCA regulations for Recruited Researchers. The exact (net) salary will be confirmed upon appointment and is dependent on local tax regulations and on the country correction factor (to allow for the difference in cost of living in different EU Member States). The salary includes a living allowance, a mobility allowance and a family allowance (if applicable). The guaranteed PhD funding is for 36 months (i.e. EC funding, additional funding is possible, depending on the local Supervisor, and in accordance with the regular PhD time in the country of origin). In addition to their individual scientific projects, all fellows will benefit from further continuing education, which includes internships and secondments, a variety of training modules as well as transferable skills courses and active participation in workshops and conferences.

On-line Recruitment Procedure (see Appendix 1)
All applications proceed through the on-line recruitment portal on the https://helios-dn.eu/ website. Candidates apply electronically for one to maximum three positions and indicate their preference. Candidates provide all requested information including a detailed CV (Europass format

obligatory) and motivation letter. During the registration, applicants will need to prove that they are eligible (cf. Recruited Researchers definition in Horizon Europe MSCA work programme 2023-2024, mobility criteria, and English language proficiency):

- Supported researchers must be doctoral candidates, i.e. not already in possession of a doctoral degree at the date of the recruitment.
- Researchers must be enrolled in a doctoral programme leading to the award of a doctoral degree in at least one EU Member State or Horizon Europe Associated Country.
- Recruited researchers can be of any nationality and must comply with the following mobility rule: they must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary for more than 12 months in the 36 months immediately before their recruitment date.

The deadline for the on-line application is **3rd of September 2023**. The HELIOS Selection Committee (SC) selects between 12 and maximum 20 candidates for the Recruitment Event which will take place in Leuven, Belgium (**12 October 2023 – date subject to confirmation**). The selected candidates provide a 20-minute presentation and are examined by the Selection Committee. In order to facilitate their travel, selected candidates (from outside Belgium) receive a fixed, lump sum of 250 Euro (paid by the inviting Supervisor). The final decision on who to recruit is communicated the day after the Recruitment Event. The selected DCs are to start their research as quickly as possible (target: March 2024).
Prior to the recruitment event, videoconferencing (or in person, when possible) interviews between the Supervisors and the candidates will be organized. The final decision on who to recruit is communicated no later than 13 October 2023. The selected DCs are to start their research as quickly as possible (ideally around March 2024).

Applicants need to fully respect the eligibility criteria (to be demonstrated in the Europass cv):
Conditions of international mobility of researchers:
Researchers are required to undertake trans-national mobility (i.e. move from one country to another) when taking up the appointment. At the time of selection by the host organisation, researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of their host organisation for more than 12 months in the 3 years immediately prior to their recruitment. Short stays, such as holidays, are not taken into account.
English language proficiency: Network fellows (DCs) must demonstrate that their ability to understand and express themselves in both written and spoken English is sufficiently high for them to derive the full benefit from the network training.

The 10 available PhD positions

DC1: Reduction and degradation of pellets in a hydrogen-dominated direct-reduction shaft furnace (WP1)

Host Institution: TU Delft

Country: Netherlands

Supervisors: Yongxiang Yang (TUD) – Co-supervisors: Shoshan Abrahami (TUD), Jan Van der Stel (TATA), P.K. Gupta (TATA), Petri Sulasalmi (UOULU)

Objectives:

- Identify the reduction and carburisation phenomena as a function of the process conditions in the different shaft zones (reduction, transition, cooling zones);
- Analyse the effect of process conditions and pellet properties on the resulting DRI, including a sensitivity analysis;
- Evaluate the reduction and degradation of sinter in a DRI shaft;
- Determine the kinetic and heat transfer controlled regimes for the different BF- and DR-grade pellets;
- Evaluate the in-situ reforming of methane/hydrocarbons in the reactor as carburisation agent for the DRI;
- Determine the gas utilisation efficiency;

Expected results:

- Detailed information about the interaction between direct reduction gases and BF grade and DR grade pellets and sinter under conditions which are directly relevant for the hydrogen-dominated DRI shaft furnace;
- Quantitative data on the effect of various process conditions and pellet properties on the final DRI product quality;
- Description of the in-situ reforming of methane/hydrocarbons and the gas utilisation efficiency;

Enrolment in Doctoral degree(s): TU Delft Graduate School 3mE

Planned secondments:

Host: TATA Steel; Supervisor: Guchan Yapar, Pramod Gupta; Timing: M16-21; Length: 6 months; Purpose: Working with the DRP H&M balance models to understand better the effect of hydrogen partial pressure on reduction and its kinetics.

Host: University of OULU; Supervisor: Petri Sulasalmi; Timing: M25-27; Length: 3 months; Purpose: Study of individual pellets reduction in H2-CO-CO2 atmosphere and comparison with BF condition

Candidate requirements:

- You hold a master's degree in metallurgical or materials engineering.
- You have sound knowledge in pyrometallurgical fundamentals including thermodynamics and reaction kinetics, and are acquainted with ironmaking technologies.
- You have good skills in materials sampling and knowledge in characterization with various analytical methods (XRF, XRD, ICP, SEM/EDS, EPMA etc.).
- You have laboratory experience in conducting high temperature experiments, and are familiar with using furnaces and reacting gases (in particular H_2),
- You have good communication skills in English, are proficient in report and paper writing, and can deliver good technical presentations.
- You are independent but also a good team player, and are willing to cooperate closely with other researchers and the industry partner within the project.
- You have a critical scientific attitude and have an awareness on sustainability.
- You are enthusiastic and self-motivated, ready to participate in personal training, international exchanges and public awareness activities.

DC2: Carburization and melting behaviour of hydrogen-based direct reduced iron (WP1)

Host Institution: TU Delft

Country: Netherlands

Supervisors: Yongxiang Yang (TUD) – Co-supervisors: Shoshan Abrahami (TUD), Jan van der Stel (TATA), Muxing Guo (KUL)

Objectives:

- Design, study and optimize various potential carburization methods for both iron-ore pellets and H-DRI;
- Determine the carburization mechanisms and kinetics of the pellets and the H-DRI for the most promising carburization methods;
- Evaluate the melting behaviour of the carburized pellets;

Expected results:

- Novel carburization methods, aiming for both high process efficiency (time, temperature, complexity) and optimal resulting H-DRI characteristics (C content, melting temperature);
- Identification of the maximum carburization level and the process parameters controlling the carbon content in the H-DRI pellets for the developed carburization methods;
- Established reaction kinetics and mechanisms of the most promising carburisation processes;
- Melting temperature of the various carburized pellets;

Enrolment in Doctoral degree(s): TU Delft Graduate School 3mE

Planned secondments:

Host: TATA Steel; Supervisor: Stefan Born, Pramod Gupta; Timing: M16-21; Length: 6 months; Purpose: Working with the DRP carburisation models to understand better the effect of DRI pellet carburisation and its kinetics, under different hydrogen levels in the DRP-cone (lower part of DRP facility).

Host: KU Leuven; Supervisor: Muxing Guo; Timing: M32-34; Length: 3 months; Purpose: Confocal Scanning Laser Microscopy study to investigate the melting behavior of various carburized H-DRI.

Candidate requirements:

- You hold a master's degree in metallurgical or materials engineering.
- You have sound knowledge in pyrometallurgical fundamentals including thermodynamics and reaction kinetics, and are acquainted with ironmaking and steelmaking technologies.
- You have good skills in materials sampling and knowledge in characterization with various analytical methods (XRF, XRD, ICP, SEM/EDS, EPMA etc.), and in particular identification and characterization of carbon in metals.
- You have laboratory experience in conducting high temperature experiments, and are familiar with using furnaces and reacting gases (in particular CO and natural gas).
- You have good communication skills in English, are proficient in report and paper writing, and can deliver good technical presentations.
- You are independent but also a good team player, and are willing to cooperate closely with other researchers and the industry partner within the project.
- You have a critical scientific attitude and have an awareness on sustainability.
- You are enthusiastic and self-motivated, ready to participate in personal training, international exchanges and public awareness activities.

DC3: Future EAF steelmaking with different iron-bearing raw materials (WP1)

Host Institution: University of OULU

Country: Finland

Supervisor: Ville-Valtteri Visuri (UOULU) – Co-supervisors: Petri Sulasalmi (UOULU), Jarmo Lilja (SSAB), Martin Kendall (HEEL)

Objectives:

- Develop a dynamic model for the metal-slag phase equilibria using constrained Gibbs energy minimization;
- Develop a dynamic energy balance of the process using different raw materials;
- Model the slag foaming using different carbon-containing materials;
- Set up an improved plasma model for online use;
- Apply machine-learning algorithms based on offline information to tune the model parameters;
- Couple the model predictions with off-gas measurements to detect deviations from the planned heat trajectory and differences in the observed and predicted melting rate;

Expected results:

- Dynamic process model of the EAF as a tool to assess the use of different iron-bearing raw materials and carbon-containing foaming agents;
- Capability to predict the energy balance and evolution of the phase structure of the slag during the EAF process, including the foaming of the slag;

Planned secondments:

Host: SSAB; Supervisor: Agne Bogdanoff; Timing: M33; Length: 1 month; Purpose: The secondment will focus on simulations for DRI-based EAF steelmaking. To be trained in DRI-based EAF process.

Host: Heraeus; Supervisor: Martin Kendall; Timing: M15-17; Length: 3 months; Purpose: The secondment will focus on the utilization of new sensors for the validation of the EAF model and its modules. To be trained in sensor technology.

Enrolment in Doctoral degree(s): University of OULU Graduate School (UniOGS)

Candidate requirements:

- Master's degree in Process Metallurgy, Chemical Engineering, Chemistry or Physics.
- The degree must be completed with good grades, latest by the start of the employment.
- Good proficiency in the English language (both written and spoken)
- Good communication skills and the ability to work as a part of a team and independently.

DC4: Future converter steelmaking based on hydrogen-reduced DRI (WP1)

Host Institution: TU Delft

Country: Netherlands

Supervisor: Yongxiang Yang (TUD) – Co-supervisors: Shoshan Abrahami (TUD), Bapin Rout (TATA), Frank Schrama (TATA), Martin Kendall (HEEL)

Objectives:

- Determine the lower limit of carbon in the hot metal needed for converter refining of phosphorus and nitrogen;
- Determine the impact of other elements (Si, P) in H-DRI hot metal on converter refining;
- Engineer the converter slag to enable the refining of H-DRI hot metal;

Expected results:

- Correlation between carbon concentration in hot metal and dephosphorisation and denitrogenisation;
- Engineered slag composition, including different flux additions;
- Advise on converter process control with different future hot metal compositions;

Enrolment in Doctoral degree(s): TU Delft Graduate School 3mE

Planned secondments:

Host: TATA Steel; Supervisor: Bapin Rout, Frank Schrama; Timing: M30-35; Length: 6 months; Purpose: Training and use of Tata Steel's in-house dynamic converter model Codycos for case studies, including validation with plant data analysis

Host: Heraeus; Supervisor: Martin Kendall; Timing: M25-27; Length: 3 months; Purpose: Training in in-situ sensing in converting process

Candidate requirements:

- You hold a master's degree in metallurgical or materials engineering.
- You have sound knowledge in pyrometallurgical fundamentals including thermodynamics and reaction kinetics as well as molten melts and slags, and are acquainted with steelmaking technologies.
- You have good skills in materials sampling and knowledge in characterization with various analytical methods (XRF, XRD, ICP, SEM/EDS, EPMA etc.), and in particular for handling molten metal (steel) and slag.
- You have laboratory experience in conducting high temperature experiments, and are familiar with using furnaces and reacting gases (involving molten metal and slag).
- You have good communication skills in English, are proficient in report and paper writing, and can deliver good technical presentations.
- You are independent but also a good team player, and are willing to cooperate closely with other researchers and the industry partner within the project.
- You have a critical scientific attitude and have an awareness on sustainability.
- You are enthusiastic and self-motivated, ready to participate in personal training, international exchanges and public awareness activities.

DC5: Hydrogen plasma-based reduction of chromite/chromium oxide for stainless steel production (WP2)

Host Institution: K1-MET

Country: Austria

Supervisor: Michael Zarl (K1MET) – Co-supervisors: Johannes Schenk(MUL), Mikko Jokinen (LUX)

Objectives:

- Study the reduction of pure Cr_2O_3 under hydrogen plasma conditions;
- Find a suitable method to evaluate the kinetic parameters for the reduction;
- Investigate the reduction of synthetic mixtures to simulate the behaviour of real chromium containing ores;

Expected results:

- Proof of concept of the reduction of Cr_2O_3 in laboratory scale with the use of hydrogen plasma;
- Method created for the evaluation of the kinetics of the reduction process;
- Definition of the influences of various oxides on the reduction process of Cr_2O_3;

Enrolment in Doctoral degree(s): Montanuniversitaet Leoben

Planned secondments:

Host: Luxmet; Supervisor: Mikko Jokinen; Timing: M25; Length: 1 months; Purpose: Analysis of spectrometric data from HPSR reduction process for process control

Host: Montanuniversitaet Leoben; Supervisor: Johannes Schenk; Timing: M14-15; Length: 2 months; Purpose: Training in HPSR demo plant operation

Candidate requirements:

- You have a full academic qualification (diploma/master) in a scientific discipline within technical or natural sciences (metallurgy, mechanical engineering, chemical engineering, physics, or related fields).
- You possess a strong background in physics or chemical engineering, with a particular emphasis on plasma physics or metallurgy.
- You demonstrate excellent analytical and problem-solving skills, enabling you to contribute to process understanding and identify innovative methods.
- You exhibit strong dedication and motivation to contribute to the development of unique and relevant solutions for leading companies in the metal producing industries.
- You possess social competences and an accessible personality, allowing you to effectively solve problems as part of a team.
- You have decent presentation skills and autonomous time management capabilities, which are desired for the role.
- You are capable of working both autonomously and as part of a team, collaborating effectively with researchers from different backgrounds.
- You have a proficiency in the English language, which is obligatory for the position, and proficiency in the German language would be advantageous.
- You have a willingness to stay updated with the latest advancements in the field and apply new knowledge to the project.

DC6: Hydrogen plasma as green alternative reductant in the Argon Oxygen Decarburization (AOD) process for stainless steel (WP2)

Host Institution: KU Leuven

Country: Belgium

Supervisor: Annelies Malfliet (KUL) – Co-supervisors: Bart Blanpain (KUL), Guillaume Lefebvre (APER), Michael Zarl (K1MET)

Objectives:

- Investigate the reduction phenomena of Cr and other elements in slag by HPSR;
- Determine the efficiency of chromium-oxide reduction by hydrogen plasma as a function of slag and process characteristics;

Expected results:

- Proof of concept of the reduction of Cr_2O_3 in synthetic slags;
- Relation between chromium oxide reduction efficiency as a function of slag composition and process characteristics;
- Reduction phenomena during HPSR of Cr_2O_3-containing slag;

Enrolment in Doctoral degree(s): LU Leuven Arenberg Doctoral School

Planned secondments:

Host: Aperam; Supervisor: Guillaume Lefebvre, Steven Dilliën; Timing: M9-11; Length: 2 months; Purpose: Insights in current functioning of AOD process + extensive industrial AOD stainless steel slag characterization

Host: K1-MET; Supervisor: Michael Zarl; Timing: M8; M16; Length: 1+1 months; Purpose: Lab-scale tests on HPSR of Cr_2O_3-based materials

Candidate requirements:

- You hold a master's degree in materials engineering, metallurgy or chemical engineering or master in chemistry or geology.
- You have a strong scientific background and are committed to high quality research.
- You want to use your skills and knowledge to develop new and greener ways to produce stainless steel.
- You are excited about doing high temperature experiments, characterize samples, analyze data and interpret your findings.
- You are ambitious, well organized and have excellent communication skills.
- You speak and write fluent English and have the ability to work effectively and collaboratively.
- You are an enthusiastic and motivated person, ready to participate in personal trainings, international travel and public awareness activities.

DC7: Metal recovery by hydrogen reduction of stainless-steel process residues (WP2)

Host Institution: KU Leuven

Country: Belgium

Supervisor: Bart Blanpain (KUL) – Co-supervisors: Annelies Malfliet (KUL), Jérémy Chaulet (APER), Yongxiang Yang (TUD)

Objectives:

- Investigate the reduction of a complex oxide mix by hydrogen gas or hydrogen-plasma;
- To reach at least the same separation ability as standard pyrometallurgical process;

Expected results:

- Flowsheet to recover different metals (Fe, Zn, Ni, Cr) through the use of hydrogen reduction of hydrogen-plasma reduction;
- Determined feasibility to separate the different metals as a function of reduction conditions;
- Relation between reduction efficiency, residue composition and gas/plasma composition;

Enrolment in Doctoral degree(s): KU Leuven Arenberg Doctoral School

Planned secondments:

Host: Aperam; Supervisor: Jérémy Chaulet; Timing: M19-20; Length: 2 months; Purpose: A study of the energy balance of past, present, and future reductants for a circular economy in the stainless steel industry

Host: TU Delft; Supervisor: Yongxiang Yang; Timing: M32-34; Length: 2 months; Purpose: Hydrometallurgical treatment as complementary step in the recovery of H-reduced metals from complex residues

Candidate requirements:

- You hold a master's degree in materials engineering, metallurgy or chemical engineering or master in chemistry or geology.
- You have a strong scientific background and are committed to high quality research.
- You want to contribute to the circular economy and use your skills and knowledge to develop recycling processes for steel residues.
- You are excited about doing high temperature experiments, characterize samples, analyze data and interpret your findings.
- You are ambitious, well organized and have excellent communication skills.
- You speak and write fluent English and have the ability to work effectively and collaboratively.
- You are an enthusiastic and motivated person, ready to participate in personal trainings, international travel and public awareness activities.

DC8: Advanced online hydrogen measurement technologies within the hydrogen-plasma smelting reduction process (WP3)

Host Institution: Heraeus

Country: Belgium

Supervisors: Martin Kendall (HEEL) – Co-supervisors: Michel Van Vlierberghe (HEEL), Michael Zarl (K1MET), Susanne Michelic (MUL), Timo Fabritius (UOULU)

Objectives:

- Develop a sensor to measure dissolved gases, specifically hydrogen, continuously within the liquid metal produced by the HPSR process;
- Integrate the measurement system into the process control procedures to allow optimisation of the process and reactions;
- Develop other liquid metal sensing systems, namely sampling and temperature measurement, to improve the HPRS process;

Expected results:

- Sensor capable of continuously measuring dissolved hydrogen in liquid steel in the HPRS process;
- Integration of the sensor into the HPRS process;

Enrolment in Doctoral degree(s): Montanuniversitaet Leoben

Planned secondments:

Host: K1-MET; Supervisor: Michael Zarl; Timing: M12-13; Length: 2 months; Purpose: Training in HPSR operation and measurements

Host: Univeristy of OULU; Supervisor: Timo Fabritius; Timing: M33-36; Length: 3 months; Purpose: Evaluation of hydrogen measurements in EAF by OES, Hydris sensor and/or newly developed continuous hydrogen sensor

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DC9: Advanced characterisation of hydrogen plasma and the related reduction phenomena (WP3)

Host Institution: University of OULU

Country: Finland

Superviser: Timo Fabritius – Co-supervisors: Henri Pauna (UOULU), Mikko Jokinen (LUX), Johannes Schenk (MUL)

Objectives:

- Identify the plasma state in different process steps with process data, camera images, and spectroscopic means;
- Develop process control procedures based on empirical data;
- Find the optimal parameters to run the HPSR process;

Expected results:

- Capability to identify critical process steps and how the reduction proceeds from the data with advanced data analytics;
- Optimized process routines and decreased power and H2 consumption;

Enrolment in Doctoral degree(s): University of OULU Graduate School (UniOGS)

Planned secondments:

Host: Montanuniversitaet Leoben; Supervisor: Johannes Schenk; Timing: M12-14; Length: 3 months; Purpose: to be trained in experimental planning and conducting HPSR experiments

Host: Luxmet; Supervisor: Mikko Jokinen; Timing: M18-20; Length: 3 months; Purpose: to be trained in process control of HPSR

Candidate requirements:

- Master's degree in Process Metallurgy, Chemical Engineering, Chemistry or Physics.
- The degree must be completed with good grades, latest by the start of the employment.
- Good proficiency in the English language (both written and spoken)
- Good communication skills and the ability to work as a part of a team and independently.

DC10: Sustainability and economical assessment of future steelmaking routes (WP3)

Host Institution: KU Leuven

Country: Belgium

Supervisor: Karel Van Acker (KUL) – Co-supervisors: Yongxiang Yang (TUD)

Objectives:

- Determine the environmental impacts and possible hotspots in the developed metallurgical flowsheets;
- Assess the economic viability of emerging hydrogen metallurgical routes for a multitude of (policy and economic) scenarios;
- Assess the decarbonisation potential and possible shifts in burden of hydrogen metallurgy in Europe;

Expected results:

- Model and results for environmental and economic sustainability of new hydrogen steel production routes;
- Decarbonisation potential and environmental impact of the transition towards hydrogen metallurgy in Europe;

Enrolment in Doctoral degree(s): KU Leuven Arenberg Doctoral School

Planned secondments:

Host: TU Delft; Supervisor: Yongxiang Yang; Timing: M22-24; Length: 3 months; Purpose: Analysis of process conditions in the H-DRI-EAF/OBSF-BOF route, and its environmental and economic implications.

Host: Aperam; Supervisor: Guillaume Lefebvre; Timing: M35-36; Length: 2 months; Purpose: Development of economic models to study the shift in the market by applying hydrogen-plasma reduction processes for stainless steel production

Candidate requirements:

- You hold a master's degree in materials, metallurgical, energy or mechanical engineering engineering science, or engineering technology) or in business engineering with a strong technological background, or you can show similar experience in a related field.
- Specific expertise in one or more of the following areas is mandatory: LCA, criticality assessments, economic modeling, and environmental LCC.
- You have a scientific, critical attitude and thrive in an interdisciplinary research environment.
- You can demonstrate your interest in sustainability issues.
- You have good communication and presentation skills, proficient in English.
- You have an independent working style, and at the same time also a good team player.
- You are enthusiastic and motivated, ready to participate in personal training, international exchanges, and public awareness activities.

DN HELIOS project abstract and key project information

The HELIOS Doctoral Network will train 10 motivated and talented Doctoral Candidates (DCs) in breakthrough technologies for the hydrogen-based production of green steel, including both carbon steel and stainless steel. These DCs will be equipped with the necessary science capital and diverse transferable skills to pursue their careers in Europe and become the experts that our society needs to achieve the climate-neutral production of steel by 2050.

The intersectoral training programme (HELIOS has 4 academic and 1 non-academic Beneficiaries) is dedicated to the technical and economic challenges and innovative developments associated with the transition to hydrogen-based green-steel production. It covers a wide range, from process development, monitoring, engineering and modelling to safety engineering and lifecycle and economic analysis. The combination of state-of-the-art doctoral research projects, intersectoral secondments and supervision by leading companies and universities will be the foundations of HELIOS's success.

Research Objectives:

- Engineer processes and develop models to leverage the H-DR route to the same state-of-the art level as the BF-BOF route in Europe with respect to process, energy and resource efficiency as well as product quality
- Develop first-of-a-kind hydrogen plasma-based reduction processes for stainless-steel producers and their raw-material producers
- Develop metal-recovery processes for residues from steel production based on hydrogen and/or hydrogen plasma-based reduction
- Develop measuring and analysis tools and models to support the application of hydrogen-based processes in the carbon and stainless-steel production routes

General coordinator for DN HELIOS:
Prof. Annelies Malfliet (KU Leuven)
annelies.malfliet@kuleuven.be

Project Manager DN HELIOS:
Ionuț-Alexandru Popa (KU Leuven)
ionut.popa@kuleuven.be

HELIOS Consortium:

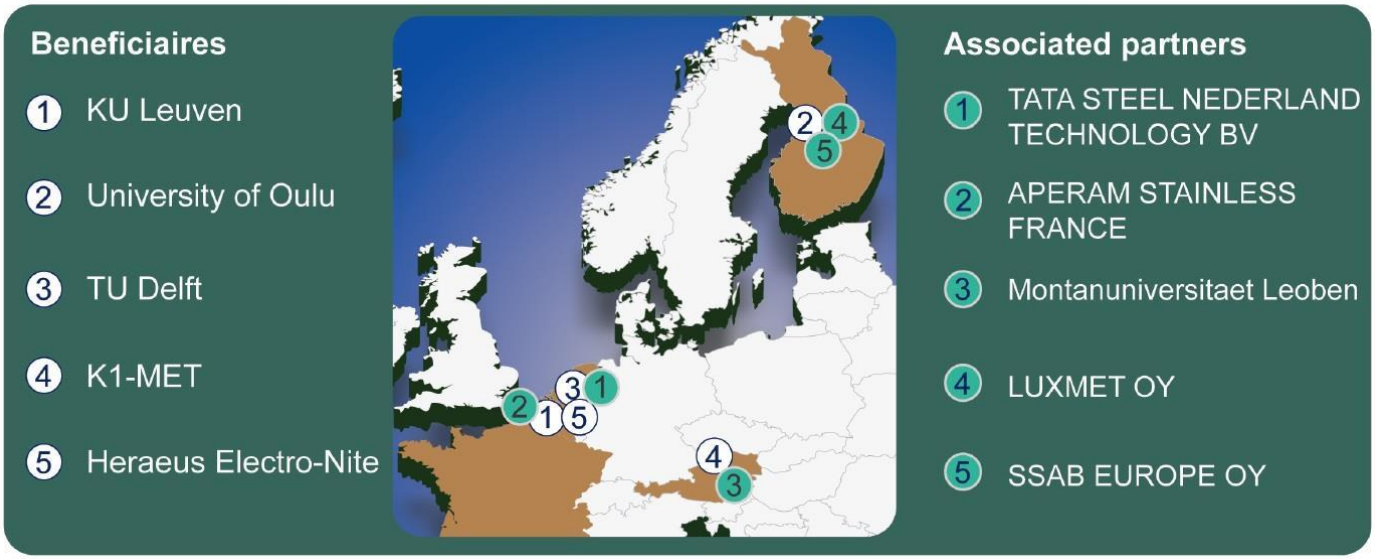

Figure 1: HELIOS CONSORTIUM

HELIOS research programme overview:

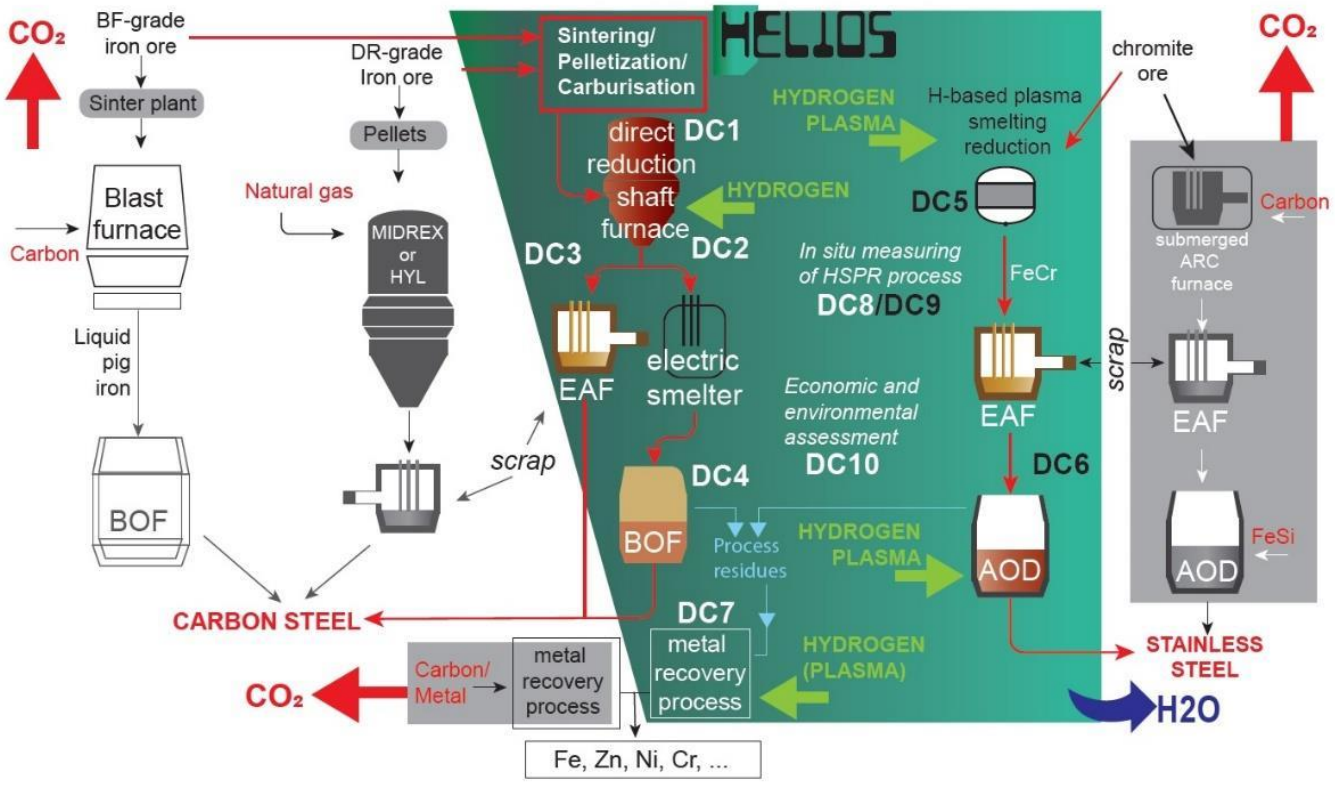

Figure 2: The scope and interconnectivity of the HELIOS DN

Appendix 1: Recruitment Procedure and Principles

A HELIOS recruitment webpage is put on-line (May 2023), as part of the HELIOS project website: https://helios-dn.eu/

Key dates

- 1 June 2023: Launch of 10 DC Positions
- 3 September 2023: Deadline for on-line application
- 15 September 2023: Circulation list "HELIOS pre-selected candidates"
- 12 October 2023: HELIOS Recruitment Event (date subject to confirmation)
- 13 October 2023: Circulation list "selected HELIOS DCs"
- March 2024: Targeted starting date for DC contracts (or earlier, if possible)

Applications are made through an on-line, eligibility-proof form on the HELIOS recruitment webpage. The candidates apply for a maximum of three specific DC positions and list their order of preference. The Supervisors provide the names of their preferred candidates to the Selection Committee (SC), which in its turn produces a short list of candidates: 2 per position. As such a maximum of 20 DCs (from an initial expected pool of 120-200 candidates) are invited to the Recruitment Event (Leuven, M1).

Each candidate gives a presentation and is interviewed by the SC. After a thorough evaluation, the candidates are ranked and a collective decision is made. In this way a complementary team of DCs can be assembled, as positively experienced from previous similar recruitment events.

In case not all 10 DCs can be recruited during the collective Recruitment Event, the recruitment procedure is "decentralised", meaning that the involved supervisors continue the search for good candidates. The SC is kept informed at all times when new eligible candidates appear. The SC makes an official complaint in case the Code of Conduct for the Recruitment of Researchers is breached. The involved supervisor is then expected to find another candidate. Recruitment problems are also, if still needed, discussed during the Network Wide Event meeting (M8) in order to deliver specific action plans to target specific networks relevant for the vacant DC positions.

All details concerning the recruitment-procedure principles are communicated on the on-line application portal, so that potential DCs know exactly what to expect and are stimulated to apply. All recruitment (pre and final selection) is in line with the European Charter for Researchers, providing the overarching framework for the roles, responsibilities of both researchers and employers. The Code of Conduct for the Recruitment of Researchers functions ensures that the selection procedures are transparent and fair.

The recruitment strategy of HELIOS fully complies with the Code of Conduct definition of merit. For example, merit is not just measured by a researcher's grades, but on a range of evaluation criteria, such as teamwork, interdisciplinary knowledge, soft skills and awareness of the policy impact of science.

The SC has members of each gender and considers the promotion of equal opportunities and gender balance as part of the recruitment strategy. Also, in view of the RRI principles, special efforts are made to attract women DCs from new EU Member States.

HELIOS aims for a gender balanced participation of DCs in the network. Researchers are employed on fixed-term contracts and are registered as staff candidates for PhD degrees. Therefore, they are entitled to pension contributions, paid holidays, and other benefits as governed by the universities and industrial companies.

For any inquiries regarding the recruitment procedure, please send an email to info@helios-dn.eu