

**SELECTION OF ONE ASSOCIATE PROFESSOR FOR THE ACADEMIC RECRUITMENT FIELD 09/A3 – “INDUSTRIAL DESIGN, MACHINE CONSTRUCTION AND METALLURGY” - ACADEMIC DISCIPLINE ING-IND/21 “METALLURGY” AT THE ACADEMIC CLASS OF EXPERIMENTAL AND APPLIED SCIENCES - TECIP INSTITUTE, PURSUANT TO ART. 24, SUBSECTION 5 AND 5BIS, OF ITALIAN LAW 240/2010, ISSUED BY RECTOR DECREE NO. 242 DATED 06/05/2024.**

The Committee for the evaluation of Dr. Valentina Colla, tenure-track – probationary, assistant professor pursuant to Italian Law no. 240/2010, art. 24 paragraph 3 letter B, in order to promote her to Associate Professor in the Academic Recruitment Field 09/A3 – Industrial Design, Machine Construction And Metallurgy” – Academic Discipline ING-IND/21 “Metallurgy” at the Academic Class of Experimental and Applied Sciences and TeCIP Institute, nominated by the Rector by decree No. 325, dated 3/06/2024, consists of:

- Prof. Marcello Cabibbo, Full Professor in the Academic Recruitment Field 09/A3 – Industrial Design, Machine Construction And Metallurgy” – Academic Discipline ING-IND/21 “Metallurgy” at the University Politecnica of Marche, as designated expert member by TeCIP Institute;
- Prof. Timo Fabritius, Full Professor of Process Metallurgy at the University of Oulu, Finland;
- Prof. Francesco Iacoviello, Full Professor in the Academic Recruitment Field 09/A3 – Industrial Design, Machine Construction And Metallurgy” – Academic Discipline ING-IND/21 “Metallurgy” at the University of Cassino and Lazio Meridionale;
- Prof. Annalisa Pola, Full Professor in the Academic Recruitment Field 09/A3 – Industrial Design, Machine Construction And Metallurgy” – Academic Discipline ING-IND/21 “Metallurgy” at the University of Brescia;
- Prof. Maurizio Vedani, Full Professor in the Academic Recruitment Field 09/A3 – Industrial Design, Machine Construction And Metallurgy” – Academic Discipline ING-IND/21 “Metallurgy” at the University” at the Politecnico of Milan.

The Committee convened via teleconference on June 19, 2024, at 3.45 p.m. from the following locations:

Prof. Marcello Cabibbo located in Ancona, connected via MS Teams;

Prof. Timo Fabritius located in Oulu (Finland), connected via MS Teams;

Prof. Francesco Iacoviello located in Cassino, connected via MS Teams;

Prof. Annalisa Pola located in Brescia, connected via MS Teams;

Prof. Maurizio Vedani located in Milano, connected via MS Teams;

The members of the Committee stated that each of them has examined Dr. Colla's application and made his/her individual assessment, which are reported in Annex 1 of these minutes.

At 4 p.m. they open the public meeting at the link:

<http://sant'annapisa.webores.com/sant'annapisa/q.php?MTID=m0:eaecb6806uda91b201c8ba9c56a077>.

The Committee ascertained that some members of the School' academic staff are connected to the meeting.

Dr. Colla declared to have chosen for her lesson the following topic: "Direct Reduction of Iron Ore in Shaft Furnaces: Basic Notions and Recent Trends" and started the lesson at 4:15 p.m..

At 5:28 p.m. Dr. Colla' lesson ended, and the Committee asked her some questions.

At 5:40 p.m. the Committee ended the public meeting with Dr. Colla.

Then they collectively examined the publications, curriculum and teaching activities of the candidate and discussed about the quality of her lesson, compared their individual assessments and prepared a collegiate assessment, which is reported as Annex 2 of these minutes, of which it is an integral part.

Then, after a discussion on the basis of unanimous consensus, the Committee declared that Dr. Colla:

is qualified to be appointed as associate professor.

Given the conclusion of the selection procedure for one position of Associate Professor in the Academic Recruitment 09/A3 – Industrial Design, Machine Construction and Metallurgy" – Academic Discipline ING-IND/21 "Metallurgy" at the Academic Class of Experimental and Applied Sciences and TeCIP Institute pursuant to art. 24, subsection 5 of Italian law 240/2010, the President declared the work closed.

These minutes, and the attached declarations of the Committee's members connected via teleconference will be given to the Personnel Office in order to these proceedings to be verified, with a decree by the Rector.

The session closed at 6:00 p.m.

Read, approved and signed,

The Committee

## ATTACH 1 - INDIVIDUAL ASSESSMENTS

### Individual assessment by Prof. Marcello Cabibbo

#### Teaching activity

De. Colla has supervised several bachelor's and master's degree thesis, she also supervised and tutored PhD thesis.

#### Publications

Dr. Colla has a scopus record of 270 publications so far, with a H index of 31 and total citation index of more than 3800. The 12 submitted publications were mostly on Q1 ranking. This places her in the first best quartile for number of products published in the top 25% of SJR in the last three years among associate professors in their disciplinary sector. She also possesses national qualification for associate and full professorship.

#### Research activity

The post-PhD research activity of Dr. Colla started more than 25 years ago (1998), and this chiefly focused on reuse and recycling of by-products of the steel production cycle. In this respect, Dr. Colla was one of the pioneering researchers investigating and promoting, within the steel sector, the development of specific digital solutions to improve sustainability of steel production and enhance by-products valorisation. In particular, the research activity aimed at finding technological solutions largely unexplored, such as, for instance, slag management and characterization, and water management. Moreover, she also founded in 2001 a research team called ICT for Complex Industrial Systems and Processes (ICT-COISP) that now includes several members including associate professors, researchers and PhD candidates. Within this research group she contributed to develop flowsheet models of ironmaking and steelmaking processes to jointly estimate steel metallurgy and main chemical components of different types of slags as well as their use within decision support systems assessing the viability of different slag valorisation paths. Among the other research activities that Dr. Colla has followed so far, can be here mentioned some of primary interest, such models to estimate hot deformation resistance of micro-alloyed in plate rolling process; studies on the behaviour of hydrogen in steel such as hydrogen embrittlement, and related blooms following stack cooling. She also developed a Genetic Algorithms-based optimization system, which exploits hybrid models to identify the most suitable steel metallurgy to achieve a target Jominy profile. Developing of models based on experimental and industrial data to estimate microstructural evolution of Dual-Phase high-strength steels undergoing continuous annealing and galvanizing through parametric representations of the Continuous Cooling Transformation diagram. Research activities on novel C-lean steel production processes supporting the decarbonisation of the sector.

#### International activity and Third Mission

Dr. Colla was coordinator in competitive international projects funded by the EU. She was also involved in 4 projects funded by the Horizon Europe framework, in 2 of the with the role of project coordinator. So far, she managed about 16 M€ of funded research activities, of which about 75% in the last 10 years, and about 25% acquired in the contractual period as researcher with the Sant'Anna school.

Dr. Colla has also established continuing collaboration with foreign institution such K1-MET in Austria, SWERIM in Sweden, BetriebsForschungsInstitut in Germany. She also actively collaborate with foreign universities: Lorraine (France), Leoben (Austria), Oulu (Finland), Lulea (Sweden),

RWTH Aachen (Germany), Universidad Politecnica de Madrid (Spain), Sieć Badawcza Łukasiewicz – Instytut Metalurgii Żelaza (Poland), Technical University of Dortmund (Germany).

In 2023 the Research Executive Agency nominated V. Colla as chairman of the technical group TGA5 "Steel Factories – Smart and Human" of the RFCS due to her consolidated experience in the development of research activity in the steel sector.

Overall, the level in research, publications, third mission activities of Dr. Colla can be considered excellent.

Based on the assessment, Dr. Colla is here considered fully qualified to be appointed as associate professor.

### **Individual assessment by Prof. Maurizio Vedani**

#### Teaching activity

Dr. Valentina Colla list in her CV the supervision/mentoring of several PhD theses (3 in the most recent period as assistant professor) and M.Sc theses. She also held 2 courses for PhD students and a module at a Seasonal School in the last 3 years.

#### Research activity and publications

Shortly after her PhD (gained in 1998) Dr. Colla founded her own research team focussed on ICT for complex industrial systems and processes at the Scuola Superiore Sant'Anna. The team currently includes a total of 16 scholars and PhD fellows mainly working on reuse and recycling of by-products originated from steelmaking processes.

The research activity of Dr. Colla is extremely intense and outstanding. It is generally based on the implementation of digital solutions to improve sustainability of steelmaking processes and to enhance by-products valorisation. The research topics can be divided into four main lines: the advanced modelling of mechanical behaviour of steels for automotive and civil applications, the control and prediction of microstructural transformations also using neural networks and hybrid approaches, the application of mathematical and AI-based tools for the modelling, simulation, monitoring and control of steel processes, the development of novel C-lean production processes supporting the decarbonization of the steelmaking industry.

The listed research topics have been developed over the years through the coordination and participation to a wide number of national and international research projects, allowing to establish a well consolidated research network and the collection of a significant amount of funding.

The bibliometric track of records shows a total of 3500+ citations in the last 15 years, resulting in a H-index of 31. A significant share of the 270 publications is placed in the first quartile of SJR.

#### International activity and Third Mission

Dr. Colla is very active within the international steel community by virtue of the above-mentioned international projects and the continuous collaboration with a large number of foreign research institutions. Her reputation has been confirmed by the nomination in 2023 as chairperson of the technical group TGA5 "Steel Factories – Smart and Human" of Research fund for Coal and Steel (RFCS) due to her consolidated experience in the development of research activity in the steel sector.

#### Overall evaluation

I can state that the outstanding scientific activity presented by Dr. Colla makes her fully qualified to be appointed as Associate Professor.

#### **Individual assessment by Prof. Timo Fabritius**

##### Teaching activity

Assistant prof. Valentina Colla has strong documented experience of student supervision in all three levels: B.Sc., M.Sc. and PhD. She has supervised several B.Sc., M.Sc. and PhD. thesis during her career. Assistant prof. V. Colla's pedagogical, teaching and educational expertise is clearly demonstrated by number of supervised thesis and given courses and lessons.

##### Research activity and publications

During the last years Dr. V. Colla's special attention has targeted to a) mechanical behaviour of materials, b) microstructural transformations and its modelling, c) simulation, modelling and controlling metallurgical processes by modern AI methods and d) developing new low CO<sub>2</sub> steelmaking processes. Her scientific approach is very well in line with the global consensus to generate scientific support for twin transition towards sustainable industry and society.

She has also established very good research group to support and deep research in sustainable ironmaking and steelmaking. Her focus has been in recycling of different side streams in steelmaking processes and utilizing various artificial intelligence (AI) and machine learning (ML) methods for simulations and modelling of unit processes. She has published 270 peer-reviewed papers in the top scientific journals and has continuously accelerating citations according to Scopus (3840 citations & H-index 31).

##### International activity and Third Mission

Assistant prof. Colla has very actively involved and led research in national funded research projects using different funding instruments. She has built wide and comprehensive international network not only with academia but also with industry ensuring also industrial relevance of her research. Furthermore, she has worked very actively and recognized high-level expert in European level by preparing, leading and coordinating Horizon Europe (HE) and Research Fund of Coal and Steel (RFCS) projects developing more sustainable steelmaking processes and operations. She has nominated as chairperson for the technical group TGAS "Steel Factories – Smart and Human" of Research fund for Coal and Steel (RFCS) in 2023.

##### Overall evaluation

Based on my judgement Assistant professor Valentina Colla has very clearly demonstrated to achieve excellence in scientific research and high-quality teaching. She has also evidenced excellent activity in the international scientific community and academic leadership in her actions to improve even further her own and her research team performance in the future.

As a conclusion, I evaluated that assistant professor Valentina Colla fulfils the requirements for promotion and is qualified to be appointed to Associate Professor.

#### **Individual assessment by Prof. Francesco Iacoviello**

##### Teaching activity

Dr. Colla has held some courses for PhD students, participated to many exams' committees, supervised several bachelor's and master's degree thesis, and supervised and tutored PhD thesis.

#### Publications

Dr. Colla possesses national qualification for associate and full professorship. She has a Scopus record of 270 publications cited by 2705 documents, with a H index of 31. The 12 submitted publications were mostly on Q1 ranking. This places her in the first best quartile for number of products published in the top 25% of SJR in the last three years among associate professors in their disciplinary sector.

#### Research activity

The post-PhD research activity of Dr. Colla started in 1998, and this is mainly focused on reuse and recycling of by-products of the steel production cycle. In 2001 Dr. Colla founded a research team named Steel and Industrial Automation Division included in the PERCRO Laboratory of Scuola Superiore Sant'Anna. The activity of such group mainly focused on modelling, simulation, monitoring, management, and optimisation solutions for the metallurgical sector and, in particular, for the steel industry as well as for the manufacturing industry connected to these sectors.

Dr. Colla carried and is still carrying out her research activity mainly along four main research lines:

- 1) mechanical behaviour of materials, working on advanced modelling of the mechanical behaviour of steels for automotive and civil applications.
- 2) microstructure transformation and its prediction, by means of shallow and deep Neural Networks and hybrid approaches to estimate the hardenability profile of micro-alloyed steels, developing a Genetic Algorithms-based optimization system and developing a simplified finite element model for the prediction of the thermal, metallurgical and mechanical behaviour of rebars produced through the TempCore process.
- 3) intelligent management of steel production facilities, optimizing the application of mathematical and statistical tools and AI techniques for modelling, simulation, monitoring, and control of processes related to both integrated and electric steel production route
- 4) Novel C-lean steel production processes supporting the decarbonisation of the sector.

#### International activity and Third Mission

Dr. Colla was coordinator in competitive international projects funded by the EU. She was also involved in 4 projects funded by the Horizon Europe framework, in 2 of the with the role of project coordinator. Dr. Colla has also established continuing collaboration with different foreign institutions.

In 2023 the Research Executive Agency nominated V. Colla as chairman of the technical group TGA5 "Steel Factories – Smart and Human" of the RFCS due to her consolidated experience in the development of research activity in the steel sector.

Overall, the level in research, publications, third mission activities of Dr. Colla can be considered excellent.

Based on the assessment, Dr. Colla is here considered fully qualified to be appointed as associate professor.

**Individual assessment by Prof. Annalisa Pola**

#### Teaching activity

Dr. Colla has supervised students for their bachelor's and master's thesis as well as PhD thesis. She's member of commissions for the selection of the ordinary BSc and MSc. Degree students in Engineering at Scuola Superiore Sant'Anna. Recently, she has also been involved in teaching courses for PhD students of Scuola Superiore Sant'Anna.

#### Research activity and publications

To date Dr. Colla has 270 publications indexed in Scopus, with a H Index of 31 and total citations of 3,842. The 12 publications submitted for the evaluation are well distributed over the last 15 years, showing the constant research activity, and are all on Q1 or Q2 ranked Journals.

She is also owner of a European patent (Appl. No. 501 739) on "Process for reducing fossil CO2 emissions" and possesses national qualification for associate professorship since 2017.

The research activity of Dr. Colla has been mainly focused on: advanced modelling of the mechanical behaviour of steels for automotive and civil applications; use of neural networks and hybrid approaches to estimate microstructure transformations in steels; application of mathematical and statistical tools and AI techniques for modelling, simulation, monitoring, and control of steel production route; modelling of direct reduction process in novel C-lean steel production processes, etc. She also contributed to a novel prototypical experimental apparatus and experimental procedure exploiting hydrogen permeation techniques to assess the effect of inhibitors in hydrochloric steel pickling of Low-C and Interstitial-Free steels.

#### International activity and Third Mission

Dr. Colla is involved in 4 Projects funded by the Horizon Europe framework, covering the role of project coordinator in 2 projects.

She has consolidated cooperations with many foreign research centres and universities (eg. K1-MET, BetriebsForschungsInstitut, SWERIM, universities of Leoben, RWTH Aachen, etc.) as also demonstrated by her publications (based on SciVal, the scholarly output of Dr. Colla between 2018 and 2024 is mostly classified as International collaboration).

Speaker in many international conferences and member of several Technical Program Committee (TCP) of international conferences, demonstrating the high level of her international scientific activity.

Based on her recognised reputation in the development of research activity in the steel sector in 2023 she was nominated by the Research Executive Agency chairman of the technical group TGAS "Steel Factories ~ Smart and Human" of the the Research Fund for Coal and Steel (RFCS).

#### Overall evaluation

Considering the above-mentioned activities, Dr. Colla can be considered thoroughly qualified to be appointed as associate professor.



## ATTACH 2

### COLLEGIATE ASSESSMENTS

#### Teaching activity

Dr. Colla has supervised students for their bachelor's and master's thesis as well as PhD thesis. Dr. Colla's teaching and educational expertise is clearly demonstrated by number of supervised thesis and given courses and lessons.

#### Research activity and publications

To date Dr. Colla has 270 publications indexed in Scopus, with a H index of 31 and total citations of 3,842. The 12 publications submitted for the evaluation are well distributed over the last 15 years, showing a constant research activity, and are all on Q1 or Q2 ranked Journals.

All the publications submitted for the evaluation show significant originality, innovation, and methodological rigor and are fully coherent with the specific topics of the Academic Discipline ING-IND/21 "Metallurgy".

#### International activity and Third Mission

During the last three years, Dr. Colla has been involved in 4 Projects funded by the Horizon Europe framework, covering the role of project coordinator in 2 projects. She has built wide and comprehensive international network not only with academia but also with industry, ensuring industrial relevance of her research activity. She was nominated as chairperson for the technical group TGAS "Steel Factories – Smart and Human" of Research fund for Coal and Steel (RFCS) in 2023.

#### Lecture given by Dr. Colla during this meeting

Dr. Colla's lecture was exhaustively clear and scientifically sound although a bit longer than the fixed timing. The slide and material she prepared were detailed and well structured and suitable for a PhD lecture level.

#### Overall evaluation

Considering the above-mentioned credits, together with the evaluation of the lecture, Dr. Colla is considered by this committee thoroughly qualified to be appointed as associate professor.

