



Outotec

H2020 EID Metal_Intelligence – Six PhD positions available

Trinity College Dublin (Ireland), Lulea University of Technology (Sweden) and Outotec (Finland) Oy are partners in a H2020 European Industrial Doctorate Network called Metal_Intelligence. The network is currently filling **six PhD** positions in the areas of ore characterisation, ore processing, geometallurgical modelling, mineral process simulation and technology-enhanced learning. All positions will start on September 1st 2017. Applications are being reviewed and close on May 31st. Candidates with backgrounds in economic geology, mineralogy, minerals processing, geometallurgy, analytical chemistry & software development are encouraged to apply.

1) PhD student position at TCD **Analytical Mineralogy** – Efficient characterisation of minerals and fabrics with the scanning electron microscope. For more information, email Juan Diego Rodriguez-Blanco (j.d.rodriquez-blanco@tcd.ie)

2) PhD student position at TCD **Geochemistry** – Novel ways of rapid characterisation of trace matters/elements in metallic ore. For more information, email Balz Kamber (kamberbs@tcd.ie)

3) PhD student position at LTU **Mineral Processing** – Innovative paths for mineral liberation analysis. For more information, email Jan Rosenkranz (jan.rosenkranz@ltu.se).

See also: <https://www.ltu.se/ltu/Lediga-jobb?!=en&rmpage=job&rmjob=2219&rmlang=UK>

4) PhD student position at LTU **Ore Geology** – Characterisation of ore deposits for use in geometallurgical modelling. For more information, email Christina Wanhainen (christina.wanhainen@ltu.se).

See also: <https://www.ltu.se/ltu/Lediga-jobb?!=en&rmpage=job&rmjob=2231&rmlang=UK>

5) PhD student position at Outotec **Processing Simulation** – Dynamic, adaptive and predictive models for simulation of mineral processing. For more information, email Antti Roine (antti.roine@outotec.com)

6) PhD student position at Outotec **Virtual Training Methodology** – Development of new virtual training tools and methodology for mineral processing plant systems. For more information, email Antti Roine (antti.roine@outotec.com)



ESR-I: PHD-STUDENT IN ANALYTICAL MINERALOGY

BACKGROUND

We are looking for a PhD student in Analytical Mineralogy. The student will join an established research group to work with a research project on efficient characterisation of minerals with scanning electron microscopy. The project is funded within the Marie Skłodowska-Curie Innovative Training Network Metal_Intelligence run at Trinity College Dublin together with academic and industry partners.

SUBJECT DESCRIPTION

Analytical Mineralogy consists of determining and quantifying the mineralogy of natural and human-made materials, usually natural rocks and sediments, metal ores, industrial minerals and products from the mining processing industry.

DUTIES

Qualitative and quantitative mineral analysis are currently achieved through a number of solid-state and microscopy techniques, like powder X-ray diffraction, X-ray fluorescence and medium and high-resolution microscopy (from the classical petrographic microscopy to automated scanning electron microscopy), among others. All these analysis require which all require laborious sample preparation. Scanning electron microscopy (SEM) is the most rapid and industry relevant method for determining mineralogy of raw materials via energy dispersive spectroscopy (EDS) chemistry analysis and also to visualise grain association and mineral liberation.

This project will develop flexible, research-friendly data analysis tools for SEM-EDS. The work involves the following tasks:

- *Developing flexible, research-friendly data analysis tools for SEM-EDS.*
- *Planning and conducting analytical work (in situ chemistry and mineralogy, powder mineralogy) for selected Irish-type Pb-Zn deposits.*
- *Comparing the accuracy of modal mineralogy from a variety of ore-bearing rock samples obtained with SEM-EDS with powder X-ray diffraction data (using the Rietveld refinement method).*
- *Testing experimental setups for maximum throughput analysis with multiple silicon drift detectors.*
- *Collaborate with R&D department of the affiliated industry partner Oxford Instruments to implement faster and more accurate means for predicting the mineralogy of raw materials.*

PhD studies within this Marie Skłodowska-Curie Innovative Training Network (ITN) involve a mobility scheme for participating in trainings given by the different network partners as well as an industrial internship.

The PhD studies at Trinity College are conducted over a 3-4 year period, fulltime, and involve engagement with undergraduate tutorial delivery. This position is open for EU citizens.

QUALIFICATIONS

Eligible candidates for the position must have a master or equivalent degree in mineralogy, material sciences or other relevant programmes. The candidate is expected to have a solid background in mineralogy, crystallography and geochemistry. Experience with powder X-ray diffraction and high-resolution microscopy are an asset.

REMUNERATION

Annual Living Allowance:	€31,480.86
Annual Mobility Allowance:	€6,501.13
Family Allowance (if applicable)	€5,417.61

INFORMATION

Entrance to the position: Enrolment starting with September 1st, 2017.

For more information please contact: Dr. Juan Diego Rodriguez-Blanco, +353 1 896 1691, j.d.rodriguez-blanco@tcd.ie

APPLICATION

Application packages need to contain a CV, a letter of motivation, copies of degree certificates and relevant Course transcripts and contact details of at least two academic referees. Mark your application with the ref no below. Candidates are encouraged to identify an alternative project should their first choice already be filled.

*To fulfill the European Commission requirements for this position, the candidate must have, or soon receive, a degree that permits him/her to enter a PhD program. This might be a Masters degree, a "Diplome", an Honours Bachelor or 4 year Bachelor, or equivalent. Candidates need to graduate **before** September 2017. By the time of appointment, candidates will have shown evidence of English language proficiency (test certificate).*

The Innovative Training Network program was designed by the European Commission to enhance mobility and training opportunities so one of the requirements is that young researchers be trained in a country other than their own. Therefore, the candidate must not have lived for more than 12 months in the 3 year period immediately prior to the start date in the country that will host him/her for the project, in this case, in the Republic of Ireland.

Deadline for application: May 31st, 2017



ESR-2: PHD-STUDENT IN GEOCHEMISTRY

BACKGROUND

We are looking for a PhD student in Geochemistry. The student will join an established research group to work with a research project on novel ways of rapid characterisation of trace matters/elements in metallic ore. The project is funded within the Marie Skłodowska-Curie Innovative Training Network **Metal_Intelligence** run at Trinity College Dublin together with academic and industry partners.

SUBJECT DESCRIPTION

Advanced *in situ* analytical geochemistry using laser ablation inductively-coupled-plasma spectroscopy techniques (mass spectrometry and/or optical emission spectroscopy) are capable of quantifying sub-parts-per-million concentrations of elements, including energy critical elements in natural and human-made materials and this information in aiding efficient mineral processing.

DUTIES

Mineralogical and elemental analysis is currently achieved for the major constituents of ore bodies and mineral processing plant feed using scanning electron microscopy (SEM). When not present as separate phases, trace concentrations of precious or certain penalty metals are difficult to quantify with an SEM. Equally, trace matters that can negatively impact on minerals processing plants may not be detected or quantified chemically and require structural data. Thus, the lack of such data for better minerals processing plant operation is diminishing efficiency and increasing energy consumption.

Expected Results: Improved understanding of the nature of harmful trace matters and a pilot methodology for identification of their presence. An empirical prediction of their effect on process response

This project will develop flexible, research-friendly data analysis tools for SEM-EDS. The work involves the following tasks:

- Scale-up laser-ablation ICP-MS based trace metal analysis for samples previously analysed for mineral liberation analysis by SEM.
- Develop an analytical protocol for simultaneous SEM-Raman characterisation of trace matters, such as carbonaceous matter in plant feed.
- Understanding the physical parameters that determine behaviour of trace matter in minerals processing.
- Develop models for prediction of behaviour of trace metals in minerals processing.
- Collaborate with affiliated industry Agnico Eagle Kitilla Mine, Finland to implement better recovery of precious metals.

PhD studies within this Marie Skłodowska-Curie Innovative Training Network (ITN) involve a mobility scheme for participating in trainings given by the different network partners as well as an industrial internship.

The PhD studies at Trinity College are conducted over a 3-4 year period, fulltime, and involve engagement with undergraduate tutorial delivery. This position is open to EU citizens.

QUALIFICATIONS

Eligible candidates for the position must have a master or equivalent degree in mineralogy, geochemistry or material sciences. The candidate is expected to have a solid background in mineralogy, economic geology and geochemistry. Experience with laser ablation ICP-MS and high-resolution microscopy is an asset.

REMUNERATION

Annual Living Allowance:	€31,480.86
Annual Mobility Allowance:	€6,501.13
Family Allowance (if applicable)	€5,417.61

INFORMATION

Entrance to the position: Enrolment starting with September 1st, 2017.

For more information please contact: Balz Kamber, kamberbs@tcd.ie

APPLICATION

Application packages need to contain a CV, a letter of motivation, copies of degree certificates and relevant Course transcripts and contact details of at least two academic referees. Mark your application with the ref no below. Candidates are encouraged to identify an alternative project should their first choice already be filled.

To fulfill the European Commission requirements for this position, the candidate must have, or soon receive, a degree that permits him/her to enter a PhD program. This might be a Masters degree, a "Diplome", an Honours Bachelor or 4 year Bachelor, or equivalent. Candidates need to graduate before September 2017. By the time of appointment, candidates will have shown evidence of English language proficiency (test certificate).

The Innovative Training Network program was designed by the European Commission to enhance mobility and training opportunities so one of the requirements is that young researchers be trained in a country other than their own. Therefore, the candidate must not have lived for more than 12 months in the 3 year period immediately prior to the start date in the country that will host him/her for the project, in this case, in the Republic of Ireland.

Deadline for application: May 31st, 2017

ESR₃: PHD-STUDENT IN MINERAL PROCESSING,

BACKGROUND

*We are looking for a PhD student in Mineral Processing. The student will join an established research group to work with a research project on quantification of mineral liberation using X-ray tomography. The project is funded within the Marie Skłodowska-Curie Innovative Training Network **MetalIntelligence** run at Luleå University of Technology together with academic and industrial partners.*

SUBJECT DESCRIPTION

Mineral Processing deals with the unit operations and processes for treating particulate solids, primarily metal ores, industrial minerals and solid fuels, but also residues and recyclable waste material as well as products from the processing industry.

DUTIES

Mineral liberation analysis is currently achieved through a number of laboratory analyses which all require laborious sample preparation. At its best, with automated mineralogy (Auto-SEM-EDS), it is a powerful tool to diagnose and control the comminution circuit. To operate a plant, a paradigm shift is required in order to optimize size reduction for mineral liberation instead of targeting for particle size only. Further, the analysis should be available as an on-line tool.

The project will develop X-ray tomography tools for mineral identification and liberation analysis for selected ores. The work involves the following tasks:

- *Moving the research front from crack and porosity analysis to mineral identification (segmentation) and liberation analysis*
- *Developing software and user interface for post-processing X-ray tomography data*
- *Planning and conduct of experimental work for selected ores*
- *Validating cutting-edge, non-destructive X-ray tomography for mineral liberation against traditional techniques (SEM)*
- *Assessing the potential for process-relevant on-line analysis*
- *Reporting to the network partners*

PhD studies within this Marie Skłodowska-Curie Innovative Training Network (ITN) involve a mobility scheme for participating in trainings given by the different network partners as well as an industrial internship.

The PhD studies are 4 year, fulltime. Administration and/or lecturing of maximum 20% may be added.

QUALIFICATIONS

Eligible candidates for the position must have a master degree of at least 120 ECTS in mineral processing, resource engineering or other relevant programmes. The candidate is expected to have a solid background within mineral processing and process mineralogy as well as good knowledge in image processing and computer science. Experiences with X-ray tomography and programming are seen as a merit.

A written proof of good English language proficiency (test certificate, relevant transcript of records or a confirmation letter) is required. At Luleå University of Technology, the PhD students will normally conclude a licentiate degree halfway through their studies. PhD students will be offered a position for 4 to maximum 5 years (if teaching or other departmental work is included in the position). Regulations can be found in Högskoleförordningen 5 kap §§ 1-7. Local guidelines for salary exist.

INFORMATION

Entrance to the position: Enrolment starting with September 1st, 2017.

For more information please contact: Professor Jan Rosenkranz, +46-(0)920-49 2183, jan.rosenkranz@ltu.se or Assistant Professor Cecilia Lund +46-(0)920-49 2354, cecilia.lund@ltu.se.

Representatives of the unions SACO, TCO, and OFR can be reached through LTU's switch board: +46 - 920-49 10 00.

APPLICATION

You apply for this position by clicking on the link below. Your application must include motivation letter, CV, a written proof of your English proficiency and copies of diplomas from university. Mark your application with the ref no below.

Deadline for application: May 31st, 2017



ESR4: PhD student in Ore Geology

BACKGROUND

We are looking for a PhD student in Ore Geology with focus on ore characterization. The PhD-project will comprise mineral chemistry and process mineralogy in a detailed deposit study in the Bergslagen ore district in Sweden. The project is funded within the Marie Skłodowska-Curie Innovative Training Network MetalIntelligence run at Luleå University of Technology together with academic and industrial partners.

SUBJECT DESCRIPTION

Ore Geology is concerned with the behavior, occurrence and genesis of naturally occurring economic concentrations of metallic mineral resources. The research aims to describe the geological conditions that lead to economic concentrations of metals and, in some cases, also non-metallic mineral resources.

Geometallurgy brings together ore geology, mineral processing and metallurgy in order to characterize physical and chemical properties of rocks and ore from the in situ ore stage through the extraction and beneficiation stages to the final product. The aim is to optimize processes, minimize waste and reduce costs in the mine to mill operation.

DUTIES

The character of the ore will be documented in terms of ore textures, mineralogy, metal content, mineral associations, metal distribution etc, using geometallurgical and mineralogical techniques (e.g. hyperspectral methods, XRD, SEM-WDS, Laser Ablation ICP-MS, QEMSCAN, and X-ray tomography). Results will have to be prepared for use within the larger framework of geometallurgical modeling to provide a base for predicting mineral process performance and mine planning considering the geological variability of the ore. One goal within the project is therefore to make analysis available as on-line tools.

PhD studies within this Marie Skłodowska-Curie Innovative Training Network (ITN) involve a mobility scheme for participating in trainings given by the different network partners as well as an industrial internship. Continuous reporting of activities and results to the network partners is an important task included in the work. The PhD studies are 4 year, fulltime. Administration and/or lecturing of maximum 20% may be added.

QUALIFICATIONS

Applicants must have excellent academic credentials and recently completed their MSc or equivalent degree in Geosciences with specializations in mineralogy, ore geology or other relevant program, and be admitted for post graduate studies. The applicants must possess good skills in written and spoken English. Drillcore logging with emphasis on mineralogy and ore textures in the deposit area will be an important part of the study and therefore experience of this is a merit. Experience on analytical techniques is considered as an advantage.

A written proof of good English language proficiency (test certificate, relevant transcript of records or a confirmation letter) is required. At Luleå University of Technology, the PhD students will normally conclude a licentiate degree halfway through their studies. PhD

students will be offered a position for 4 to maximum 5 years (if teaching or other departmental work is included in the position). Regulations can be found in Högskoleförordningen 5 kap §§ 1-7.

Read more;

[General curricula for the Board of the faculty of science and technology](#)

INFORMATION

Entrance to the position: enrolment starting with September 1st, 2017.

Local guidelines for salary exist.

For further details regarding the above position please contact:

Associate Professor Christina Wanhainen, +46 (0)920-49 24 01, christina.wanhainen@ltu.se
or Assistant Professor Cecilia Lund, +46 (0)920-49 23 54, cecilia.lund@ltu.se.

Unions Representatives: SACO-S Daina Dagens, (+46)920-49 3880 daina.dagens@ltu.se OFR-S
Lars Frisk, (+46)920-49 1792 lars.frisk@ltu.se

Luleå University of Technology is actively working on equality and diversity that contributes to a creative study- and work environment. The University's core values are based on respect, openness, cooperation, trust and responsibility.

In case of different interpretations of the English and Swedish versions of this announcement, the Swedish version takes precedence.

APPLICATION

We prefer that you apply for this position by clicking on the apply button below. The application should include a CV, personal letter and copies of verified diplomas from high school and universities. Your application, including diplomas, must be written in English or Swedish. Mark your application with the reference number below.

Final day to apply: May 31st, 2017

ESR-5: PHD-STUDENT IN PROCESS SIMULATION

BACKGROUND

*We are looking for a PhD student in process simulation focussing on dynamic, adaptive and predictive simulation model development. The student will join the Outotec Modelling and Simulation team with several research projects developing process modeling platforms and applications. The project is funded within the Marie Skłodowska-Curie Innovative Training Network **Metal_Intelligence** coordinated by Trinity College Dublin (TCD) together with academic and industry partners.*

SUBJECT DESCRIPTION

The project will benefit from the state-of-the-art simulator of network beneficiary Outotec (HSC Chemistry), as well as from access to the laboratory-scale plant at secondment partner Luleå University of Technology (LTU). The current state-of-the-art simulators mimic the plant at a general level only, but they do not have specific predictive capability. Predictive capacity can be added by including information on the change of particle composition of the plant feed, the knowledge of how changing plant feed affects mineral separation behaviour, the quality of the process products and tailings, and the energy costs associated with the process. This on-line information will be obtained from the laboratory scale plant and then be implemented into the simulator as process feedback loops. At this initial stage, the feedback loops will behave according to empirically determined laws.

DUTIES

Training of metallurgical plant staff for optimal operation of plant is currently based on mixture of class room teaching and limited hands-on exposure. This approach is limited by the sluggishness of response of a real plant and the inability to include critical events faced in real processes (e.g. power failure). By contrast training on Outotec virtual experience (digital model plants) exposes staff to a greater variety of critical situation and the models can be run at up to 5x speed. However, the virtual training tool currently mimics the plant at a general level only, but does not have specific predictive capability.

This project target is the development of a dynamic and predictive process models for virtual training in minerals processing plants. The work involves the following tasks:

- *Review existing metallurgical and mineralogical data for case plant*
- *Conduct complementary lab studies to add missing data*
- *Build full and integrated dynamic model for a plant case*
- *Verification of model and validation against training cases*
- *Design of training programme for plant staff.*

Expected Results: Improved dynamic process model with predictive capability resulting in more relevant and realistic training enabling better technology transfer across generations. Provision of library of training sessions covering a wide array of real-life scenarios.

PhD studies within this Marie Skłodowska-Curie Innovative Training Network (ITN) involve a mobility scheme for participating in trainings given by the different network partners as well as an industrial internship.

The PhD studies at Luleå University of Technology are conducted over a 3-4 year period, fulltime, and involve engagement with undergraduate tutorial delivery.

QUALIFICATIONS

Eligible candidates for the position must have a master or equivalent degree in mineralogy, geochemistry, material sciences, process metallurgy. The candidate is expected to have a solid background in mineralogy, chemistry or process metallurgy. Experience with process modeling, software development, programming and MS Visual Studio .NET are seen as a merit.

A written proof of good English language proficiency (test certificate, relevant transcript of records or a confirmation letter) is required. At Luleå University of Technology, the PhD students will normally conclude a licentiate degree halfway through their studies. Local guidelines for salary exist.

INFORMATION

Entrance to the position: Enrolment starting with September 1st, 2017.

Host institution site location:

Outotec, Kuparitie 10, 28101 Pori, Finland, or

Outotec, Rauhalanpuisto 9, 02230 Espoo, Finland

PhD: Luleå University of Technology, SE-971 87 Luleå, Sweden

For more information please contact: Dr. Antti Roine, antti.roine@outotec.com

APPLICATION

*Application packages need to contain a CV, a letter of motivation, copies of degree certificates and relevant Course transcripts and contact details of at least two academic referees. **Mark your application with the ref no below.** Candidates are encouraged to identify an alternative project should their first choice already be filled.*

*To fulfill the European Commission requirements for this position, the candidate must have, or soon receive, a degree that permits him/her to enter a PhD program. This might be a Masters degree, a "Diplome", an Honours Bachelor or 4 year Bachelor, or equivalent. Candidates need to graduate **before** September 2017. By the time of appointment, candidates will have shown evidence of English language proficiency (test certificate).*

The Innovative Training Network program was designed by the European Commission to enhance mobility and training opportunities so one of the requirements is that young researchers be trained in a country other than their own. Therefore, the candidate must not have lived for more than 12 months in the 3 year period immediately prior to the start date in the country that will host him/her for the project, in this case, in the Finland.

Deadline for application: May 31st, 2017

ESR-6: PHD-STUDENT IN VIRTUAL TRAINING METHODOLOGY

BACKGROUND

We are looking for a PhD student in virtual training simulator development, which focusses on new virtual training tools and methodology for mineral processing plant systems. The student will join the Outotec Modeling and Simulation team with several research projects developing process modeling platforms and applications. The project is funded within the Marie Skłodowska-Curie Innovative Training Network **Metal_Intelligence** coordinated by Trinity College Dublin (TCD) together with academic and industry partners.

SUBJECT DESCRIPTION

The project will perform a systematic pedagogic analysis of the currently used virtual experience learning facility of Outotec. This will be achieved through statistical analysis of training outcomes and results. Equipped with these data, the ESR will then move to the secondment partner TCD, where they will be hosted by the ADAPT centre. Over the course of the secondment, the parallel running ESR 5 will have advanced the dynamic features of the simulator and the expertise in technology-enhanced learning at ADAPT will be used to find learner-friendly ways of including this additional complexity of operation. These measures will then be implemented into the simulator and a new set of learning outcome data will be analysed both in 'static' and 'dynamic' mode of operation.

DUTIES

Virtual training in minerals processing plant operation has many advantages over conventional classroom and hands-on training. It has been claimed to improve the learning outcomes, but the extent of improvement has not been quantified to date. In addition, whereas a classroom teacher can respond to the needs of individual learners, the current virtual training is not yet able to address particular learning difficulties. This limitation needs to be addressed.

This project target is to improve the pedagogic value of virtual training in minerals processing plant operation. The work involves the following tasks:

- Conducting a pedagogic analysis of existing training sessions
- Producing a catalogue of training success by analysis of test results, exam results and trainee evaluation feedback
- Scientific impartial comparison of training success between conventional and virtual training
- Introduction of certified procedure ensuring quality of training using pedagogic principles
- Develop virtual training tools based on the review results.

Expected Results: Apart from providing a quantitative comparison of conventional and virtual training effectiveness, this project will adapt the existing virtual training to improve outcomes for trainees with specific learning difficulties.

PhD studies within this Marie Skłodowska-Curie Innovative Training Network (ITN) involve a mobility scheme for participating in trainings given by the different network partners as well as an industrial internship.

The PhD studies at Trinity College Dublin are conducted over a 3-4 year period, fulltime, and involve engagement with undergraduate tutorial delivery.

Antti Roine

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QUALIFICATIONS

EU citizens are eligible candidates for this position. They must have a master or equivalent degree in mineralogy, geochemistry, material sciences, process metallurgy. The candidate is expected to have a solid background in mineralogy, chemistry or process metallurgy. Experience with process modeling, software development, or pedagogy are seen as a merit.

The candidate will be enrolled at Trinity College Dublin and has told hold a test certificate of English language proficiency.

INFORMATION

Entrance to the position: Enrolment starting with September 1st, 2017.

Host institution site location:

Outotec, Kuparitie 10, 28101 Pori, Finland, or

Outotec, Rauhalanpuisto 9, 02230 Espoo, Finland

PhD: Trinity College Dublin, School of Natural Sciences, Dublin 2, Ireland

For more information please contact: Dr. Antti Roine, antti.roine@outotec.com

APPLICATION

*Application packages need to contain a CV, a letter of motivation, copies of degree certificates and relevant Course transcripts and contact details of at least two academic referees. **Mark your application with the ref no below.** Candidates are encouraged to identify an alternative project should their first choice already be filled.*

*To fulfill the European Commission requirements for this position, the candidate must have, or soon receive, a degree that permits him/her to enter a PhD program. This might be a Masters degree, a "Diplome", an Honours Bachelor or 4 year Bachelor, or equivalent. Candidates need to graduate **before** September 2017. By the time of appointment, candidates will have shown evidence of English language proficiency (test certificate).*

The Innovative Training Network program was designed by the European Commission to enhance mobility and training opportunities so one of the requirements is that young researchers be trained in a country other than their own. Therefore, the candidate must not have lived for more than 12 months in the 3 year period immediately prior to the start date in the country that will host him/her for the project, in this case, in the Finland.

Deadline for application: May 31st, 2017