15 PhD positions in the EU Horizon 2020 Marie Skłodowska-Curie MSCA-ETN Project NEW-MINE (EU Training Network for Resource Recovery Through Enhanced Landfill Mining, Project 721185)

Applications are invited for 15 PhD positions ("Early Stage Researchers") to be funded by the Marie-Sklodowska-Curie Innovative Training Network "NEW-MINE – EU Training Network for Resource Recovery Through Enhanced Landfill Mining" within the Horizon 2020 Programme of the European Commission. NEW-MINE is a consortium of high profile universities, research institutions and companies located in Belgium, Germany, Austria, Switzerland, Sweden, Italy and UK.

Number of positions available:
15 PhD positions

Research Fields
Mechanical Engineering - Environmental Engineering - Materials Engineering - Chemistry – Chemical Engineering – Metallurgy

Keywords
Circular economy; recycling; raw materials; landfill mining; gasification; pyrolysis; low-carbon building materials; syngas; LCA; TEA; multi-criteria assessment; remediation;
exploration

Career Stage
Early Stage Researcher (ESR) or 0-4 yrs (Post Graduate)

Benefits and salary
The successful candidates will receive an attractive salary in accordance with the MSCA regulations for early stage researchers. The exact salary will be confirmed upon appointment and is dependent 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 married). The guaranteed PhD funding is for 36 months (i.e. EC funding, additional funding is possible, depending on local Supervisor). 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 for full description)
All applications proceed through the on-line recruitment portal on the www.new-mine.eu website. Candidates apply electronically for one to maximum three positions and indicate their preference. Candidates provide all requested information including a detailed CV. During the registration, applicants will need to prove that they are eligible, according to the ESR definition, mobility criteria, and English language proficiency. The deadline for the on-line registration is **30 July 2016**. The NEW-MINE Recruitment Committee selects between 20 and maximum 30 candidates for the Recruitment Event which will take place in Leuven (**6 September 2016**). The selected candidates provide a 15

minute presentation and are examined by the Recruitment Committee. In order to facilitate their travel, selected candidates (from outside Belgium) receive a fixed, lump sum of 250 euro (paid by the prioritised Supervisor). The final decision on who to recruit is made the day after the Recruitment Event. The selected ESRs are to start their research as quickly as possible (**target: 1 November 2016**).

Applicants need to fully respect three eligibility criteria:
Early-stage researchers (ESR) are those who are, at the time of recruitment by the host, in the first four years (full-time equivalent) of their research careers. This is measured from the date when they obtained the degree which formally entitles them to embark on a doctorate, either in the country in which the degree was obtained or in the country in which the research training is provided, irrespective of whether or not a doctorate was envisaged.
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: Network fellows (ESRs) 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. See for instance:
http://www.helsinki.fi/facultyofscience/postgraduate/postapplicant.html).

The 15 available positions

ESR 1: Modelling the landfill subsurface through integration of multi-sensor geophysical data
Objectives: To establish boundary conditions for the application of geophysical sensors to different types of landfills, varying in terms of general architecture and nature and heterogeneity of contained waste, in view of ELFM. To advance data processing with respect to integrating and inverse modelling of multi-sensor geophysical datasets, conditioning of modelling to output of test excavations (interaction with ESR2).
Host: UGent (Belgium) & Cranfield University (UK)
Lead Supervisor: Prof. Mark Van Meirvenne (UGent, Marc.VanMeirvenne@UGent.be)
Duration: 36 months

ESR 2: Validation and expansion of the geophysical model by mechanical processing
Objectives: To validate the geophysical model of landfills as anthropogenic deposits by mechanical processes using lean-technology concepts. To expand the model by including indicators of material quality, quantity and mineability, derived from excavation and processing tests. To produce RDF and selected fractions for direct material recovery by mechanical processing.
Host: RWTH Aachen (Germany) & Montanuniversität Leoben (Austria)
Lead Supervisor: Prof. Thomas Pretz (RWTH, pretz@ifa.rwth-aachen.de)
Duration: 36 months

ESR 3: Modelling and validation of sensor-based sorting technologies of intergrown and surface-defiled waste
Objectives: To enhance the unlocking of intergrown particles from excavated waste by wet processing. To remove, characterise and quantify surface defilements with respect to their response in sensor-based sorting. To develop a model for sensor-based sorting of surface-defiled waste. To validate this model by sensor-based sorting on the pilot scale (RWTH).
Host: Montanuniversität Leoben (Austria) & RWTH Aachen (Germany)
Lead Supervisor: Prof. Roland Pomberger (MUL, Roland.Pomberger@unileoben.ac.at)
Duration: 36 months

ESR 4: Production of Refuse Derived Fuel from presently inappropriate waste fractions
Objectives: To study the production of RDF from presently not thermally valorised, problematic waste fractions using wet-processing methods (as opposed to dry methods which are not effective for excavated MSW). The development of the quality parameters (grain size, calorific value, chlorine content, ash content, moisture) is monitored continuously during RDF production. Special focus on the loss of energy carriers in terms of mineralisation. Therefore, an exhaust analyses system is installed at Shanks, which measures the CO concentration in the exhaust gas during the stabilisation process by infrared spectroscopy. Combined adjustment of thermal and biological parameters during the stabilisation process yields an optimal balance between moisture removal and the maintenance of high-energetic organic compounds.
Host: Shanks (Belgium) & Montanuniversität Leoben (Austria)
Lead Supervisors: Laurent Dauge (Shanks, laurent.dauge@shanks.be) & Prof. Roland Pomberger (MUL, Roland.Pomberger@unileoben.ac.at)
Duration: 36 months

ESR 5: Sustainable Municipal Solid Waste treatment by a steam plasma gasification
Objectives: To develop a novel solution, based on plasma gasification technology, to convert RDF from landfills into valuable energy forms with reduced gas emission and minimal solid waste. Verification of this novel process by experimental tests both in laboratory and in a pilot plant at ScanArc. Later, a feasibility study on the dissemination of results and on the commercial use of the developed RDF plasma gasification technology is performed.
Host: KTH (Sweden) & KU Leuven (Belgium)
Lead Supervisor: Dr. Weihong Yang (KTH, weihong@kth.se)
Duration: 36 months

ESR 6: Syngas purification by plasma tar cracking
Objectives: To study the thermochemical mechanisms of plasma tar cracking. To investigate the influence of different input and operating parameters (synthetic gas mixtures, model and real tar compounds, temperature, gas flow rate). To study the synergistic effect between thermal cracking and plasma cracking. To transfer the new insights regarding plasma tar-cracking mechanisms into an improved operation of a plasma-gasification system.
Host: KU Leuven (Belgium) & KTH (Sweden)
Lead Supervisor: Prof. Lieve Helsen (KU Leuven, Lieve.Helsen@kuleuven.be)
Duration: 36 months

ESR 7: Solar-driven thermochemical conversion of RDF – Thermodynamic/kinetic analyses and heat/mass transfer modelling
Objectives: To investigate the fundamental thermodynamics and kinetics of the high-temperature pyrolysis and gasification reactions and heat/mass-transfer characterisation of the solar reactor for thermochemically converting RDF to valuable synthetic fuels using concentrated solar energy. Specifically:

a) Thermodynamic equilibrium computations as a function of temperature, pressure, stoichiometry; Second-Law exergy analysis and determination of the theoretical maximum solar-to-fuel energy conversion efficiency;
b) Thermogravimetric analysis for measuring reaction rates of the pertinent pyrolysis/gasification reactions under various operating conditions of temperature, stoichiometry, particle size, material morphology; measurement of the effective morphological and transport proper- ties of the RDF;
c) Development of a numerical solar reactor model by formulation of the heat/mass-transfer and fluid-flow governing equations, coupled to the chemical kinetics/thermodynamics, and incorporating RDF's effective properties; numerical solution by Monte-Carlo/radiosity and finite-volume CFD techniques; model validation by comparison with experimental results obtained with the solar-reactor prototype (ESR8); application of the solar-reactor model for optimisation and scale-up.

Host: ETH Zürich (Switzerland)
Lead Supervisor: Prof. Aldo Steinfeld (ETH, aldo.steinfeld@ethz.ch)
Duration: 36 months

ESR 8: Solar-driven thermochemical conversion of RDF – Solar reactor development
Objectives: To develop the solar thermochemical technology for efficiently converting of RDF feedstocks into widely applicable, clean, and energy-rich syngas using concentrated solar energy. Specifically:

a) Design and fabrication of a 5-kW solar reactor prototype;
b) Experimental testing at ETH's High-Flux Solar Simulator under concentrated thermal radiation; parametric study for temperature, solar radiative power input, and mass-flow rates; mass/energy balance of each experimental solar run and identification of the major sources of irreversibilities; determination of the solar-to-fuel energy conversion efficiency;
c) Conceptual design of a plasma/solar-driven thermochemical reactor for 24/7 continuous operation in hybrid mode.

Host: ETH Zürich (Switzerland)
Lead Supervisor: Prof. Aldo Steinfeld (ETH, aldo.steinfeld@ethz.ch)
Duration: 36 months

ESR 9: Hollow electric arc conditioning of slags from thermochemical conversion technologies
Objectives: To turn waste into raw material. To develop an innovative hollow electrode technique for electric arc furnaces to condition slag produced during waste plasma treatment, optimal properties for upcycling technologies are adjusted. Understanding the mechanisms control- ling reactions by using hollow electrodes, creating knowledge of the relevant thermo-physical properties, their influence on slag behaviour and reduction potential.
Host: RWTH Aachen (Germany)
Lead Supervisor: Prof. Bernd Friedrich (RWTH, bfriedrich@ime-aachen.de)
Duration: 36 months

ESR 10: Novel mechanical and electro-thermal techniques for the conditioning of slags from thermochemical conversion technologies
Objectives: To upgrade the incoming variable residues into a clean, consistent feed-stock of specific chemistry, to be used in the synthesis of new materials. This is achieved by developing an optimisation algorithm for additions based on thermodynamic calculations in order to achieve low-temperature eutectics, measuring dielectric properties of designed mixtures and understanding the local micro-equilibria, subject- ing these mixtures to microwave heating where the formation of liquid phase in conjunction with the behaviour of volatile metals and halogens is understood, and eventually, by developing an efficient separation methodology to separate the amorphous, denser and larger, particles from the rest of the residue.
Host: KU Leuven (Belgium)
Lead Supervisor: Prof. Yiannis Pontikes (KU Leuven, yiannis.pontikes@kuleuven.be)
Duration: 36 months

ESR 11: Responsive inorganic polymers being reusable and recyclable for near-zero energy dwellings
Objectives: To develop inorganic polymers with an engineered porous microstructure, integrating phase-change materials (PCMs). These materials are synthesised at room temperature by "additive manufacturing" principles, where each casted layer varies in terms of additives (i.e., foaming agents and PCMs) delivering a final composite that is both heat insulating and responsive to temperature fluctuations. Unlike other materials, the use of inorganic polymer as a binder delivers a fire-resistant matrix that can be reused and recycled, minimising construction and demolition waste.
Host: Italcementi (main host, recruiting Beneficiary) (Italy), KU Leuven (Belgium), University of Padova (Italy) (dual degree KU Leuven – UNIPD)
Lead Supervisors: Dr. Monica Segata (Italcementi, m.segata@itcgr.net), Prof. Yiannis Pontikes (KU Leuven, yiannis.pontikes@kuleuven.be), Prof. Carlo Pellegrino (UNIPD, carlo.pellegrino@unipd.it)
Duration: 36 months

ESR 12: Waste-derived glass-ceramic products with novel functionalities
Objectives: To investigate the production of glass or glass-ceramic lightweight panels by viscous-flow sintering of glass mixed with iron-rich inorganic waste. To investigate the dense or porous glass-ceramic spheres, by sintering of glass/waste mixtures or by sinter-crystallisation of waste-derived glasses, to be used as novel aggregates for concrete. To investigate the dense or porous glass-ceramics from the thermal treatment of inorganic polymers. To investigate the formation of magnetic phases in dense or porous glass ceramics from glass/iron-rich waste mixtures, in order to obtain panels (by direct foaming or by binding granules with cement) acting as electromagnetic shields
Host: University of Padova (Italy)
Lead Supervisor: Prof. Enrico Bernardo (UNIPD, enrico.bernardo@unipd.it)
Duration: 36 months

ESR 13: Integrated LCA and RA methodology for environmental assessment of ELFM
Objectives: To develop a methodology for performing LCAs including risk assessment for the local impacts of landfill-mining projects, taking into account the new technologies developed in NEW-MINE, as well as of the time and spatial dynamics of the landfill-input streams. Results are: Comparison of the environmental impact of different NEW-MINE ELFM scenarios with the "Do Nothing", "Classic Remediation" and "Classic landfill mining" scenarios. Detection of the most impacting processing steps for further improvement of the ELFM concepts. Methodological guidelines for including risk assessment in LCA and for dealing with dynamic (spatial and temporal varying) inventories.
Host: KU Leuven (Belgium)
Lead Supervisor: Prof. Karel Van Acker (KU Leuven, Karel.VanAcker@lrd.kuleuven.be)
Duration: 36 months

ESR 14: Techno-Economic and Multi-Criteria Assessments of ELFM concepts and technologies
Objectives: To develop and apply a Techno-Economic Assessment method for the evaluation and fine-tuning of landfill-mining concepts and technologies. To benchmark the economic performance of different landfill-management options in terms of NEW-NINE ELFM, "do-nothing", "classic remediation" and "classic landfill mining" scenarios. To perform a Multi-Criteria Assessment of NEW-MINE ELFM scenarios for the identification of trade-offs between resource conservation, environmental impacts and private economic returns, facilitating decision-making regarding conflicting criteria.
Hosts: Linköping University (main host, recruiting Beneficiary) (Sweden), University of Antwerp (Belgium) (dual degree LIU – AU))
Lead Supervisors: Prof. Joakim Krook (LIU, joakim.krook@liu.se), Prof. Steven Van Passel (UAntwerp, steven.vanpassel@uantwerpen.be), Ass. Prof. Niclas Svensson (LIU, niclas.svensson@liu.se)
Duration: 36 months

ESR 15: Policy and market interventions for facilitating ELFM implementation
Objectives: To perform an extensive stakeholder assessment specifying policy, market and agency's (dis-)incentives for ELFM implementation and learning investments. To identify the main societal impacts of NEW-MINE ELFM scenarios and quantify their (positive or negative) monetary values based on environmental economics principles and methods. To quantitatively assess the private economic impacts on NEW- MINE ELFM scenarios of new policy measures for internalising ELFM externalities, changing market conditions and raw-material prices and learning curves.
Hosts: Linköping University (main host, recruiting Beneficiary) (Sweden), University of Antwerp (Belgium) (dual degree LIU – AU))
Lead Supervisors: Prof. Joakim Krook (LIU, joakim.krook@liu.se), Prof. Steven Van Passel (UAntwerp, steven.vanpassel@uantwerpen.be), Ass. Prof. Niclas Svensson (LIU, niclas.svensson@liu.se)
Duration: 36 months

Public Abstract NEW-MINE: Europe has somewhere between 150,000 and 500,000 landfill sites, with an estimated 90% of them being "non-sanitary" landfills, predating the EU Landfill Directive of 1999. These older landfills tend to be filled with municipal solid waste and often lack any environmental protection technology. In order to avoid future environmental and health problems, many of these landfills will soon require expensive remediation measures. This situation might appear bleak, but it does present us with an exciting opportunity for a combined resource-recovery and remediation strategy, which will drastically reduce future remediation costs, reclaim valuable land, while at the same time unlocking valuable resources. However, the widespread adoption of Enhanced Landfill Mining (ELFM) in the EU, as envisaged by NEW-MINE, urgently requires skilled scientists, engineers, economists and policy makers who can develop cost-effective, environmentally friendly ELFM practices and regulatory frameworks. All this demands a European commitment to concerted, inter- and transdisciplinary research and innovation. NEW-MINE trains 15 early-stage researchers (ESRs) in all aspects of landfill mining, in terms of both technological innovation and multi-criteria assessments. The technological innovation follows a value-chain approach, from advanced landfill exploration, mechanical processing, plasma/solar/hybrid thermochemical conversion and upcycling, while the multi-criteria assessment methods allow to compare combined resource-recovery/remediation ELFM methods with the "Do-Nothing", "Classic remediation" and "Classic landfill mining with (co-)incineration" scenarios. By training the ESRs in scientific, technical and soft skills, they become highly sought-after scientists and engineers for the rapidly emerging landfill-mining and broader raw-materials industries of Europe.

Beneficiaries: *KU Leuven, RWTH Aachen, UGent, Montanuniversität Leoben, Unversity of Padova, ETH Zürich, Linköping University, KTH Stockholm, Shanks, Italcementi*
Partner Organisations*: ScanArc, Stadler, JMR (Group Machiels), Stadler, BAV, University of Antwerp, Cranfield University*

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NEW-MINE
EU TRAINING NETWORK FOR RESOURCE RECOVERY THROUGH ENHANCED LANDFILL MINING

Appendix 1: Recruitment Procedure NEW-MINE - Full description

Initially, the search for the appropriate candidates is based on normal recruitment strategies (i.e., publication on ec.europa.eu/euraxess, Nature and Science ads, etc.; personal contacts). The pre and final selection is made in a collective, fully transparent process, led by the RC. The candidates apply for a maximum of three specific ESR projects and list their order of preference. Applications are made through an on-line, eligibility-proof form on the www.new-mine.eu website (e.g. http://redmud.org/vacancies-for-msca-etn-redmud-proj¬ect/ which attracted 91 candidates in 4 weeks). The supervisors provide the names of their preferred candidates to the RC, which in its turn produces a short list of candidates. As such a maximum of 30 potential ESRs are invited to the Recruitment Event, which coincides with the pre-kick-off meeting (Leuven, M1, 6 September 2016). Each candidate gives a presentation and is interviewed by the RC. The candidates are ranked and a collective decision is made. In this way a complementary team of ESRs can be assembled, as positively experienced from previous KU Leuven ETN recruitment events (EREAN, REDMUD, DEMETER) where resp. 12, 13 and 13 positions were filled immediately. In order to facilitate their travel, preselected candidates (from outside Belgium) will receive a fixed, lump sum of 250 euro to be paid by the prioritised Supervisor.

In the event that not all 15 ESRs can be recruited during the collective Recruitment Event, the recruitment procedure is "decentralised", meaning that the involved Supervisors continue the search for good candidates. Recruitment problems are also, if still needed, discussed during the RC meeting (M5, M12) in order to deliver specific action plans to target specific networks relevant for the missing ESR positions. All details concerning the Recruitment Procedure principles are communicated on the on-line application portal, so that potential ESRs 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 as a set of principles and ensures that the selection procedures are transparent and fair. The recruitment strategy of NEW-MINE fully complies with the Code of Conduct definition of merit. For example, merit is not just measured on researcher's grades, but on a range of evaluation criteria, such as team work, interdisciplinary knowledge, soft skills and awareness of the policy impact of science. The RC has members of each gender and considers the promotion of equal opportunities and gender balance as part of the recruitment strategy. In view of the RRI principles, special efforts are made to attract women and ESRs from new EU member states. Among equally qualified applicants, women receive preferential consideration. 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 employment benefits, as governed by the universities and industrial companies.

Recruitment committee: The RC involves the General Coordinator (P.T. Jones) and one representative per Beneficiary (L. Helsen, A. Clausen, M. Van Meirvenne, D. Höllen, J. Krook, E. Bernardo, M. Segata, W. Yang, A. Steinfeld, P. Laevers). Its goal is to oversee the recruitment of the 15 ESRs during the recruitment event. Additionally, it follows up the training progress of the ESRs and looks at their career planning. The RC meets during Workshops 1, 2, 4, 6, 8. During the Recruitment Event additional Supervisors will be present as well.

Key dates:

- 30-07-2016: Deadline for on-line application for ESR positions
- 10-08-2016: Circulation of communication list "preselected candidates"
- 06-09-2016: Recruitment Event (Leuven) for preselected candidates
- 07-09-2016: Circulation of Communication list "recruited[1] NEW-MINE ESRs"
- November 2016: Initiation of ESR research work

[1] Human Resources departments of the Beneficiaries get the chance to make a final check and attach conditions to the recruitment decision (incl. eligibility).