POLITECNICO DI MILANO

PhD in CHIMICA INDUSTRIALE E INGEGNERIA CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 41st cycle

THEMATIC Research Field: RECOVERY OF CRITICAL METALS FORM INCINERATORS ASHES

Monthly net income of PhDscholarship (max 36 months)
1500.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	Municipal solid waste incineration (MSWI) produces two residue streams: bottom ash (BA) and fly ash (FA). About 60 million tonnes of MSW incinerated in Europe in 2023, approximately 12 and 6 million tonnes of BA and FA, respectively, were produced. 55% of the BA is managed with conventional wet discharge and basic metal separation, with fines (particles under 2mm) being incorporated into low-grade aggregates or landfilled. Only 35% undergoes advanced state-of-the-art valorisation and up to 10% is directly landfilled when WtE facilities are not available. From a resource recovery perspective, BA and FA contain substantial quantities of valuable materials that largely remain unexploited and are predominantly lost in current waste management practices. FA should be considered a significant potential Cu, Zn, and Pb metal source, along with other critical raw materials such as Sb, P, Ti, V. Further, BA typically comprises 50-70% minerals, 10-30% glass and ceramics, 5-15% ferrous metals, 1-5% non-ferrous metals, and 1-5% unburned organics. Key matrix elements include Al, Si, Ca, and Fe, along with minor/trace elements such as Cu, Zn, Pb, Pt, Pd, Ag and Au. Despite their low concentrations, Pt, Pd, Cu, Ag, and Au account for 62% of BA’s estimated total value that is currently not valorised. This project aims to explore hydrometallurgy technologies to recover and valorise the CRMs as above.

Methods and techniques that will be developed and used to carry out the research	The PhD formation will be based all on the application of chemical engineering and electrochemical methodologies applied to CRM recovery from incinerator ashes. The starting engineering culture of the PhD candidate will be completed with the electrochemical culture to produce a PhD able to manage both aspects to a process design. The LCA concept in particular will be also exploited in order to validate the sustainability of the developed processes from the point of view of the environmental impact and of the economic sustainability. The approach to be followed will be the training on job, that conjugates experimental and modeling activities.A2A will be responsible for the training on job in an industrial R&D facility, to be acquainted on the assessment on the technical and economic feasibility of a future industrial plant
Educational objectives	To form a PhD able to drive the CRMs recovery industry into the new environmental goals avoiding all the misleading green washing claims. Moreover, PhD will be trained in an industrial environment on a project of industrial interest, where he/she will join engineering and management cultures
Job opportunities	In IT about 1200 new jobs are expected to be created in the field of CRMs recycling, that needs high skilled chemical process engineers embedding the concepts of the process industry with those of the circular economy. A full employment is registered so far for the PhD graduates from Politecnico di Milano
Composition of the research group	2 Full Professors 5 Associated Professors 5 Assistant Professors 15 PhD Students
Name of the research directors	Prof. Maurizio Masi

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Confidentiality):since this is a thematic scholarship, the management of Confidential Information, Results and their publication is subordinate to the restrictions agreed upon with the funding company. Upon acceptance of the scholarship, the beneficiary must sign a specific commitment.

Educational activities (funding for participation in courses, summer schools, workshops and conferences) - financial aid per PhD student per year:
1st year: around 2.000 euros per student
2nd year: around 2.000 euros per student
3rd year: around 2.000 euros per student

Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student:There are various forms of financial of for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation.