PERSONAL INFORMATION

Federica Forte

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Sex F | Date of birth 27/09/1984 | Nationality Italian

WORK EXPERIENCE

01/02/2019 - present

Researcher

at ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development.

Department for Sustainability (SSPT), Division Resource Efficiency (USER), Laboratory Technologies for the Reuse, Recycling, Recovery and valorisation of Waste and Materials (T4RM), Casaccia Research Center.

Her main scientific interests fall within the framework of the European strategies and initiatives in the field of circular economy in which the laboratory operates and concern the development and optimization of processes for the valorisation of complex matrices using hydro-, iono- and solvometallurgical techniques. In particular, she is working on a research line focused on the recovery of materials from lithium-ion batteries.
She is member of working group 2 (Raw Materials and Recycling) of Batteries Europe and of ERMA clusters on Rare Earths Magnets and Motors and Materials for Energy Storage and Conversion. She is involved in the activities of the Italian phosphorus platform, aimed at promoting the sustainability of the phosphorus value chain. She coordinates working group 4 (Urban Mining) of the Italian Technical Table on Critical Raw Materials.

16/03/2015 - 31/01/2019

Postdoc researcher

Catholic University of Leuven (KU Leuven), Department of Chemistry, Celestijnenlaan 200F - box 2404, 3001 Leuven, Belgium.

She was part of the SIM² KU Leuven (*Sustainable Inorganic Materials Management,* http://kuleuven.sim2.be/), active in the development and optimization of eco-innovative processes for the valorization of different type of waste streams (End-of-Life products, industrial residues, mining waste etc.). In particular her activity belonged to research line n. 2 (*Critical Metal Recovery*), focused on the development of rare earths and other critical raw materials recovery processes by means of pyro-, hydro-, solvo-, iono- and electrometallurgical techniques.

She worked as KU Leuven project leader at the EU H2020 REMAGHIC project (*New recovery processes to produce rare earth-magnesium alloys of high performance and low cost*; Grant Agreement number: 680629; 1 September 2015 – 31 August 2018).
The experimental work was focused on rare earths recovery from spent fluorescent lamps, CRTs and NiMH batteries. Within this project she worked as *internship mentor* (*Internship project: Recovery of yttrium and europium from CRTs phosphor waste*).

She worked at the development of a recovery process for lead from industrial waste streams by solvometallurgical techniques within the project IWT MIP ICON MaxiVia (*Maximum Valorization of Ferrous Industrial Waste streams*; 1 November 2014 – 31 October 2016).

EDUCATION AND TRAINING

01/10/2011 - 17/12/2014

PhD in Environmental and Infrastructure Engineering

Politecnico di Milano, Department of Civil and Environmental Engineering

Piazza Leonardo da Vinci 32, 20133, Milan

Experimental activity carried out at ENEA, Casaccia Research Center.

Title: Materials recovery from liquid crystals displays: a focus on indium

Title: with merit

Supervisor: Prof. Mario Grosso
Assistant Supervisor: Dr. Danilo Fontana, ENEA
Tutor: Prof. Michele Giugliano

She has been the assistant supervisor of three master thesis students (Politecnico di Milano, Master of Science in Environmental and Land Planning Engineering):

1. *Studio di tecnologie innovative per il trattamento e la valorizzazione dei residui della depurazione dei fumi da incenerimento di RSU* (Tomasella Lisa, academic year 2011/2012)
2. *Material Flow Analysis on Domestic High Value WEEE Generation and Collection in Finland* (Bruno Pannuzzo, academic year 2012/2013)
3. *Urban mining: the recovery of critical metals from waste electrical and electronic equipment (WEEE). The case of indium* (Giulia Pizzagalli, academic year 2013/2014)

22/02/2011

Master Degree in Environmental and Land Planning Engineering

Università degli Studi di Napoli, Federico II

Experimental activity carried out at ENEA, Casaccia Research Center.

Title: Il recupero del cobalto e del manganese da catalizzatori industriali esausti (Cobalt and manganese recovery from spent industrial catalysts).

Score: 110/110 *cum laude*

Supervisor: Prof. Ing. Francesco Pirozzi
Assistant supervisor: Dr. Danilo Fontana, ENEA

PERSONAL SKILLS

Mother tongue: Italian

Other languages: English; professional knowledge

Organizational and management skills: Excellent ability to work in teams and in multicultural environments; attitude to problem solving; excellent ability to manage responsibilities and prioritise work with respect to set deadlines and objectives.

Professional skills: Development and optimization of *critical raw materials* (CRM) recovery processes from several types of wastes (fly ash, WEEE, industrial residues).

Idrometallurgy, ionometallurgy, solvometallury.

Knowledge and application of the main aspects Project Management.

Knowledge and application of the following analytical techniques: UV-VIS, FTIR, AAS, MP-AES, ICP-OES, TXRF, IC.

Good knowledge of Microsoft applications and Office package.

Driving licence: B

PUBLICATIONS

Peer reviewed papers

- M. Pietrantonio, S. Pucciarmati, F. Forte, V. Piergrossi, C. Marcoaldi, D. Fontana. Vanadium recovery from Bayer process residue. JOM, 2023. https://doi.org/10.1007/s11837-023-06336-x.
- D. Fontana, C. Cardenia, M. Pietrantonio, S. Pucciarmati, F. Forte. Applications of advanced oxidative processes for the recovery of water from bilge water. Int. J. Environ. Sci. Technol., 2022. https://doi.org/10.1007/s13762-022-04593-y.
- D. Fontana, F. Forte, M. Pietrantonio, S. Pucciarmati, C. Marcoaldi. Magnesium recovery from seawater desalination brines: a technical review. Environ. Dev. Sustain., 2022. https://doi.org/10.1007/s10668-022-02663-2.
- M. Pietrantonio, S. Pucciarmati, L. Sebastianelli, F. Forte, D. Fontana. Materials recovery from End-of-Life wind turbines magnets. Int. J. Environ. Sci. Technol., 2021. https://10.1007/s13762-021-03546-1.
- M. Pietrantonio, S. Pucciarmati, G. N. Torelli, G. D'Aria, F. Forte and D. Fontana. Towards an integrated approach for red mud valorisation: a focus on titanium. Int. J. Environ. Sci. Technol., 2020. https://doi.org/10.1007/s13762-020-02835-5.
- F. Forte, S. Riaño and K. Binnemans. Dissolution of noble metals in highly concentrated acidic salt solutions. Chem. Commun., 2020. https://doi.org/10.1039/D0CC02298E.
- F. Forte, M. Pietrantonio, S. Pucciarmati, M. Puzone and D. Fontana. Lithium iron phosphate batteries recycling: An assessment of current status. Crit. Rev. Env. Sci. Tec., 2020. https://doi.org/10.1080/10643389.2020.1776053.
- D. Fontana, F. Forte, M. Pietrantonio and S. Pucciarmati. Recent developments on recycling end-of-life flat panel displays: A comprehensive review focused on indium. Crit. Rev. Env. Sci. Tec., 2020. https://doi.org/10.1080/10643389.2020.1729073.
- D. Fontana, M. Pietrantonio, S. Pucciarmati, C. Rao and F. Forte. A comprehensive characterization of End-of-Life mobile phones for secondary material resources identification. Waste Manage., 2019 (99), 22–30.
- L. Yurramendi, L. Gijsemans, F. Forte, J. L. Aldana, C. del Río and K. Binnemans. Enhancing rare-earth recovery from lamp phosphor waste. Hydrometallurgy 2019 (187), 38–44.
- R. Banda, F. Forte, B. Onghena and K. Binnemans. Yttrium and europium separation by solvent extraction with undiluted thiocyanate ionic liquids. RSC Adv. 2019 9, 4876–4883.
- F. Forte, L. Yurramendi, J. L. Aldana, B. Onghena and K. Binnemans. Integrated process for the recovery of yttrium and europium from CRT phosphor waste. RSC Adv., 2019 (9), 1378–1386.
- L. Gijsemans, F. Forte, B. Onghena and K. Binnemans. Recovery of rare earths from the green lamp phosphor $LaPO_4$: Ce^{3+},Tb^{3+} (LAP) by dissolution in concentrated methanesulphonic acid. RSC Advances, 2018 (8), 26349–26355.
- F. Forte, L. Horckmans, K. Broos, E. Kim, F. Kukurugya and K. Binnemans. Closed-loop solvometallurgical process for recovery of lead from iron-rich secondary lead smelter residues. RSC Advances 2017 (7), 49999–50005.
- D. Fontana, F. Forte, R. De Carolis, M. Grosso. Materials recovery from waste liquid crystal displays: A focus on indium. Waste Management 2015 (45), 325–333.
- L. Biganzoli, A. Falbo, F. Forte, M. Grosso, L. Rigamonti. Mass balance and life cycle assessment of the waste electrical and electronic equipment management system implemented in Lombardia Region (Italy). Science of the Total Environment 2015 (524–525), 361–375.
- L. Biganzoli, M. Grosso, F. Forte. Aluminium Mass Balance in Waste Incineration and Recovery Potential From the Bottom Ash: A Case Study. Waste and Biomass Valorization 2014 (5), 139–145.

Other publications

- 5° Rapporto sull'economia circolare in Italia - 2023. A cura del Circular Economy Network. Gruppo di lavoro ENEA: C. Brunori, G. Barberio, C. Cardenia, F. Ceruti, D. Claps, L. Cutaia, R. De Carolis, V. Fantin, F. Forte, M. Iorio, R. Pentassuglia, C. Rinaldi, G. Sabia, E. Salernitano, S. Sbaffoni.
- D. Fontana, F. Forte, C. Marcoaldi, O. Masetti, V. Piergrossi, M. Pietrantonio, S. Pucciarmati, M. Tammaro. Materials recovery from end-of-life electrochemical storage systems: preliminary results from the IEMAP project. Sardinia 2023 – 19th International Symposium on Waste Management and Sustainable Landfilling. Cagliari, 9-13/10/2023. ISSN: 2282-0027, ISBN: 9788862650335.
- V. Fantin, A. Giuliano, P. L. Porta, G. Barberio, C. Brunori, C. Chiavetta, D. Claps, R. De Carolis, D. Fontana, F. Forte, A. Genovese, E. Mancuso, C. Mingazzini, M. Pasquali, M. Puzone, L. Meini, F. Panvini, A. Loporcaro, G. Incarico, E. Maniscalco, M. Capellini, R.

Vannucci, M. Giombini, C. Piazza, C. Prelli, P. De Sabbata, C. Naccarato, D. Fontana, C. El Khoury, E. Rizzuto, F. Naso, S. Colombo, F. Servalli, E. Casucci, A. Sterpellone, G. Mauri, C. Giardina. L'economia circolare nelle filiere industriali: i casi tessile, abbigliamento e moda (TAM) e mobilità elettrica. ICESP Gruppo di Lavoro 4 “Sistemi di progettazione, produzione, distribuzione e consumo sostenibili e circolari”. 07/2020. doi. 10.12910/DOC2020-005.

- D. Fontana, F. Forte, P. L. Porta, M. Puzone, M. Pasquali. Le batterie al litio: catena del valore e chiusura del ciclo. Energia, ambiente e innovazione 03/2019, 125-127.
- D. Fontana, M. Pietrantonio, S. Pucciarmati, F. Forte. Il recupero di metalli di elevato valore da schede elettroniche fuori uso: una soluzione tecnologica avanzata. La Termotecnica 2019, 28-31.
- Araujo, F. Forte. REMAGHIC, New Recovery Processes to produce Rare Earth-Magnesium Alloys of High Performance and Low Cost, H2020, Volume 2018, Number 5, August 2018, 56-58, Science Impact Ltd.

Projects

- ACROBAT project (Advanced critical raw materials recycling from spent LFP batteries)
- EuBatIn project (European Battery Innovation)
- IEMAP project (Italian Platform for the accelerated discovery of materials for energy)
- EU H2020 SCRREEN 2 project (Solutions for Critical Raw materials - a European Expert Network).
- EU H2020 PLATIRUS project (PLATInum group metals Recovery Using Secondary raw materials).
- EU H2020 REMAGHIC project (New Recovery Processes to produce Rare Earth-Magnesium Alloys of High Performance and Low Cost). Main role: project leader.
- IWT MIP ICON MaxiVia project (Maximum Valorization of Ferrous Industrial Waste streams).

Other

- External jury member of the examination committee. Nor Kamariah, 2024. Advanced leaching of mineral ores and secondary resources by microwave heating and solvometallurgy. Dissertation presented in partial fulfilment of the requirements for the degree of Doctor of Science (PhD: Chemistry).

Rome, 07/06/2024

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