New Frontiers in LIBS

...from Earth to Sea and Outer Space

WORKSHOP

25-26 Nov. 2021

Porto

eit RawMaterials
Connecting matters

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Robotics Laboratory

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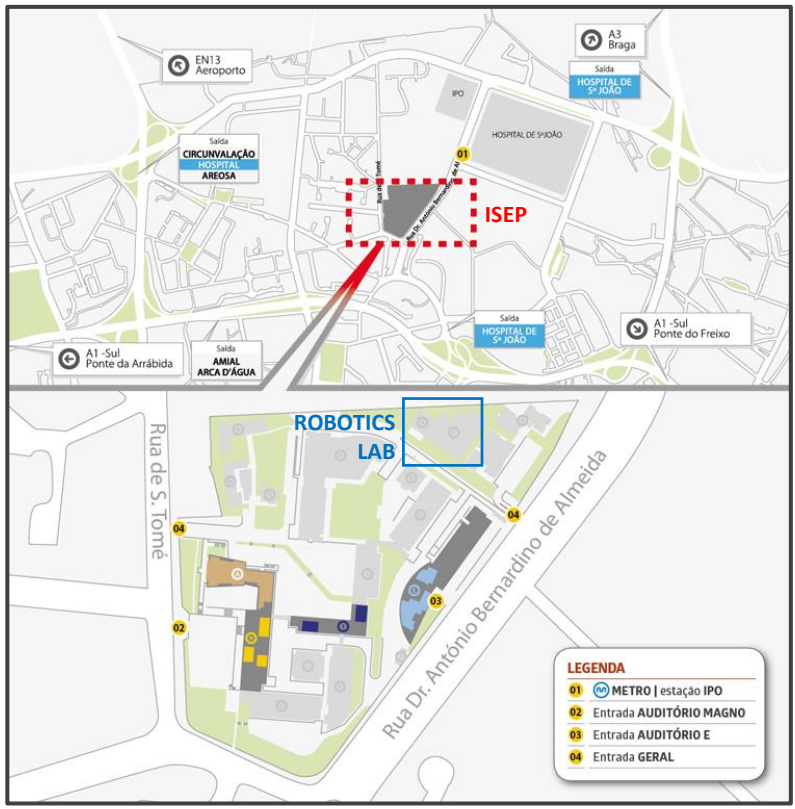

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Events

↳ In The Black

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↳ InSITE Project WORKSHOP *Click here*

Welcome Message

LIBS is a promising tool for real-time analysis of low atomic weight critical raw materials such as Li. Most solutions on the market are plagued by inconsistent results and poor quantification performance. ***inSITE*** introduces a new solution based on a modular hardware architecture coupled with advanced algorithms and a knowledge database of mineral spectra, that will enable a new generation of smart LIBS technology, adaptable to real time ore grading in challenging scenarios.

So, if you want to learn more about LIBS and about ***inSITE*** project, do not miss this opportunity that will also include a technical exhibition at INESCTEC's, Centre for Robotics and Autonomous Systems. During the exhibition you will be face-to-face with several researchers involved in numerous projects, including ***inSITE***, and you will have the opportunity to understand how the autonomous systems work, as well as several other technologies. You will be able to get to know the most renowned speakers in LIBS, underwater technologies, geo-robotics, mineral resources exploration, and many other fields will be covered! ***inSITE*** Workshop will enable networking between students, researchers, and stakeholders.

inSITE will trigger a new era of LIBS technology. It was a tough period due to COVID19, challenging all of us to develop technology and doing science in different ways: remotely. The Consortium is strong and committed to the project. ***inSITE*** has overcome all the difficulties, strengthening partnerships, and boosting our Industrial Partner, LSA.

Welcome to our story, to ***inSITE*** story and evolution, welcome to the Workshop!

Enjoy the Meeting and our beautiful city, Porto!

Stay tuned! Stay safe!

by **Pedro Jorge**, ***inSITE*** Principal Investigator

Pedro Jorge – Chairman of the Workshop

PhD, Senior Researcher
INESC TEC
Assistant Professor, FCUP
Portugal
pedro.jorge@inesctec.pt

Pedro Jorge is s PhD in Physics from Porto University (2006). He is a Senior Researcher at INESC TEC and an Assistant Professor (since 2019) at the Physics and Astronomy Department of the Faculty of Sciences of the University of Porto.

Since 2007 Pedro Jorge leads the Biochemical Sensor group at INESC TEC, exploring the potential of photonic technologies in the development of new solutions for chemical and biological monitoring in environmental, biomedical, and industrial applications. This activity is framed in a diversity of competitive national and international research projects with academia and Industry, where he acts as Principal Investigator, workpackage leader or regular team member, also supervising the training of advanced human resources at PhD and Msc level. Photonics technologies such as optical fiber sensors, interferometry, fluorescence spectroscopy, optical trapping and Laser Induced Breakdown spectroscopy are being explored in a diversity of applications ranging from systems for real time evaluation of minerals in underwater mining, to the determination of dCO2 in Aquaculture tanks, manipulation, and diagnostic of single cells.

Since 1998 Pedro Jorge co-authored 99 peer-reviewed papers, 3 book chapters and more than 200 communications in international and national conferences in the field of optical sensors. He is the author of 1 patent, and three Patent pending (EP). In total, these publications have attracted 3248 citations according to Google Scholar (user: P. A. S. Jorge) with, h-index of 32.

Eduardo Silva - Coordinator of TEC4SEA|INESC TEC

Coordinator of TEC4SEA and Professor
INESC TEC and ISEP
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Eduardo Silva is the Coordinator of the TEC4SEA platform at INESC TEC. Previously he was the Coordinator of the Centre for Robotics and Autonomous Systems (CRAS) at INESC TEC until 2019. He is also a Professor at the School of Engineering (ISEP) of the Porto Polytechnic Institute (IPP). He has a PhD in Electrical and Computer Engineering from the University of Porto. His main research areas are marine robotics, control architectures, perception, and navigation for autonomous robots. He has participated in more than 20 research projects, including ¡VAMOS! and UNEXMIN EU projects, as well as UNEXUP and inSITE Upscaling projects funded by EIT Raw Materials. He has more than 60 publications in the Field Robotics.

The Organising Team of the Workshop

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About inSITE

InSITE - Insitu ore grading system using LIBS in harsh environments

|*inSITE* is an upscaling project funded by EIT Raw Materials|

inSITE brings together a multidisciplinary research team with a renowned spectroscopy company to take to the market a new smart LIBS (Laser Induced Breakdown Spectroscopy) technology. LIBS is a powerful spectroscopy technique for element analysis with very promising features for real time assessment of composition. However, despite many systems already probing the market, its performance is only acceptable with simple samples and in controlled conditions. Its identification and quantification abilities rapidly decline with sample complexity and environmental roughness (e.g., underwater). To date no satisfactory system presents acceptable performance when facing complex mineral samples in harsh mining conditions.

Recently, however, our team has developed novel methods that allow LIBS technology to perform with improved performance even with complex mineral samples, thus enabling real time ore grading. This was achieved under the framework of Horizon 2020 VAMOS project [http://vamos-project.eu/], where the technology was validated in a relevant mining environment (TRL6). The technology is in production state and is ready to be improved to the market under the efforts of *inSITE* project.

The new LIBS technology will be suitable to perform accurately in harsh mining environments with analytical capabilities in three types of operation modes: prospection/qualitative, semi-quantitative and quantitative. The Smart-LIBS technology involves an improved concept which is based on novel chemometrics algorithms, coupled with a knowledge-database of spectra and analytical information of complex minerals. The technology can be incorporated in different hardware configurations enabling a new set of tools for smart mining, suitable for both exploration and exploitation stages.

Using patented calibration transfer methods, the technology can be incorporated in different hardware configurations enabling a new set of tools for smart mining, suitable for both exploration and exploitation stages. The project will deliver a new portable smart LIBS system suitable for in-situ identification and quantification of minerals, particularly suited for low atomic number elements, such as Lithium, where the regular technologies such as XRF do not work. In addition, exploratory works will prepare next generation of the product to work underwater, unveiling the new market of the mining activity.

The equipment has huge potential to improve the efficiency and reduce the costs and environmental footprint of mining operations. Furthermore, having such analytical capabilities in situ, is also an asset in many other fields of application and potential markets: geosciences research/services, oil and gas research and development fields.

MORE INFORMATION

ACRONYM: ***inSITE***
START: 1st January 2020
END: 31st December 2022
GLOBAL BUDGET: 1.937.146,00 €
LEAD PARTNER: INESCTEC
PRINCIPAL INVESTIGATOR: PEDRO JORGE
PROJECT MANAGER: ANA PIRES

PARTNERS INVOLVED

INESCTEC
LSA Laser Analytical Systems & Automation
Chair of Management Accounting | RWTH AACHEN UNIVERSITY
Consiglio Nazionale delle Ricerche
GeoZS Geološki zavod Slovenije
TU Delft
GHENT UNIVERSITY

FUNDED BY

RawMaterials Connecting matters
Funded by the European Union

INTERNAL MEETINGS ONLY FOR PARTNERS

inSITE Technical Meeting

23rd NOVEMBER 14h30

inSITE Steering Committee Meeting

24th NOVEMBER 14h30

in SITE WORKSHOP – DAY 1

ICE-BREAKER [14h-14h30]

25th NOVEMBER [14h30]

OPENING SESSION

- **PEDRO JORGE** (INESCTEC, Portugal): New Frontiers in LIBS: from Earth to Sea and Outer Space *(20 MIN)*

Invited KeyNote Speaker
SESSION 1: DISCOVERY, INNOVATION AND OUTER SPACE - PART I

- **JOSÉ MIGUEL VADILLO** (Universidad de Málaga, Spain) *(30 min)*

SESSION 2: ONE FOOT ON SEA AND ONE ON SHORE - GO UNDERWATER AND DIVE INTO THE FUTURE OF LIBS AND GEO-TECHNOLOGIES – PART I

- **SALVATORE SIANO** (Consiglio Nazionale delle Ricerche – CNR, Italy) *(30 min)*

COFFEE BREAK (20 min)

SESSION 3: ONE FOOT ON SEA AND ONE ON SHORE - GO UNDERWATER AND DIVE INTO THE FUTURE OF LIBS AND GEO-TECHNOLOGIES – PART II

- **JOACHIM MAKOWE** (Laser Analytical Systems & Automation GmbH – LSA, Germany) *(20 min)*
- **RUI MARTINS** (CAP/INESCTEC, Portugal) *(20 min)*
- **ALFREDO MARTINS** (CRAS/INESCTEC, Portugal) *(20 min)*

Invited KeyNote Speaker
SESSION 4: DISCOVERY, INNOVATION AND OUTER SPACE - PART II

- **SLAVKA CARVALHO ANDREJKOVICOVÁ** (GeoBioTec – University of Aveiro, Portugal; and Special External Scientist for NASA Goddard Space flight Center, USA) *(30 min)*

inSITE WORKSHOP – DAY 2

26th NOVEMBER [14h30]

Invited KeyNote Speaker
SESSION 5: DISCOVERY, INNOVATION AND OUTER SPACE - PART III

- **AMY MCADAM** (Research Space Scientist in the Planetary Environments Laboratory at NASA's Goddard Space Flight Center; SAM team Curiosity ROVER, USA) *(30 min)*

SESSION 6: ONE FOOT ON EARTH… GEOLOGY ROCKS!

- **GORAZD ŽIBRET** (Geological Survey of Slovenia – GeoZS, Slovenia) *(20 min)*
- **FEVEN DESTA** (Delft University of Technology – TUDelft, The Netherlands) *(20 min)*

SESSION 7: BUSINESS DEVELOPMENT STRATEGY FOR MINERAL RESOURCES APPROACH

- **TIM KEMPERDICK & DAVID NEUEN** (RWTH Aachen University, Germany) *(20 min)*

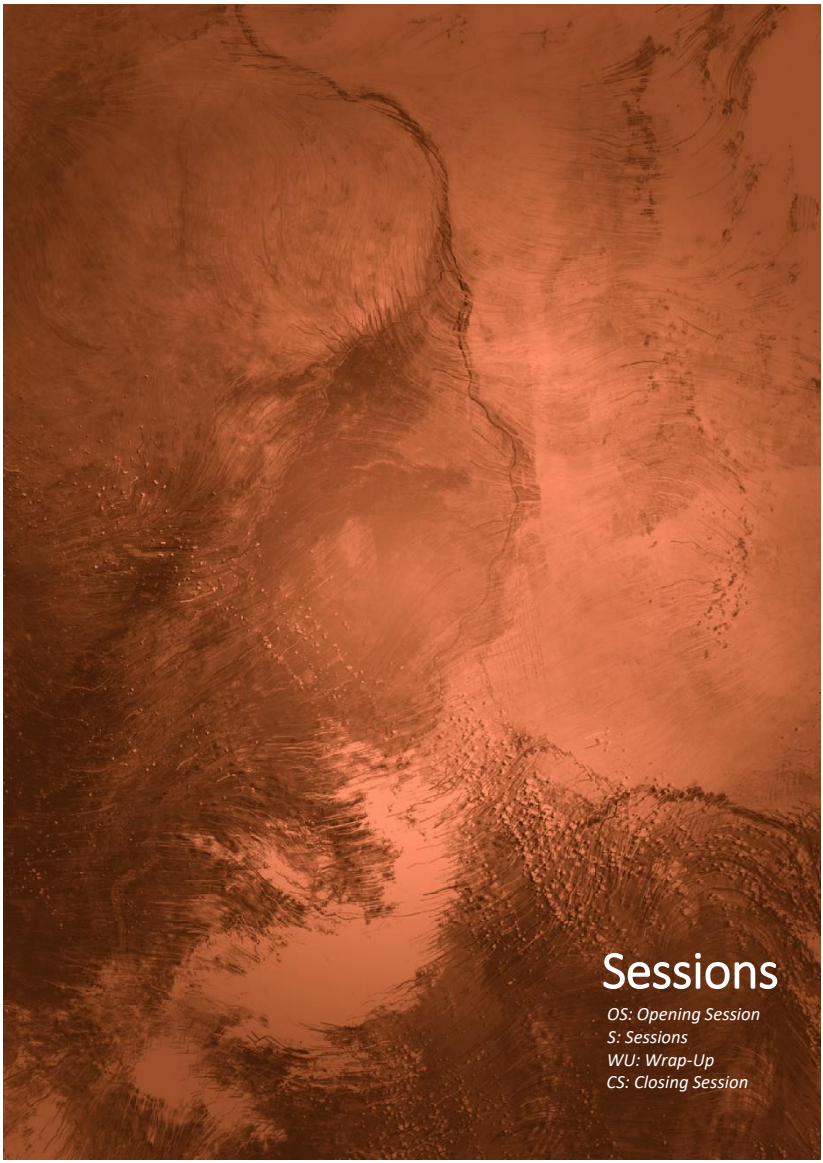
SESSION 8: DURABILITY: MATERIALS AND WEAR MECHANISMS

- **KANNAKI PONDICHERRY & MANJUNATH MANJUNATH** (Gent University - UGent, Belgium) *(20 min)*

WRAP-UP and CONCLUSIONS inSITE Workshop (**PEDRO JORGE**) *(20 min)*

CLOSING SESSION
"IN THE BLACK" AND THE "PORTUGUSE" RAW MATERIALS WEEK
(**EDUARDO SILVA**) *(10 min)*

TECHNOLOGICAL SHOW [Robotics Laboratory and Autonomous Systems, INESCTEC]


Sessions
OS: Opening Session
S: Sessions
WU: Wrap-Up
CS: Closing Session

OP	*OPENING SESSION*

New Frontiers in LIBS: from Earth to Sea and Outer Space

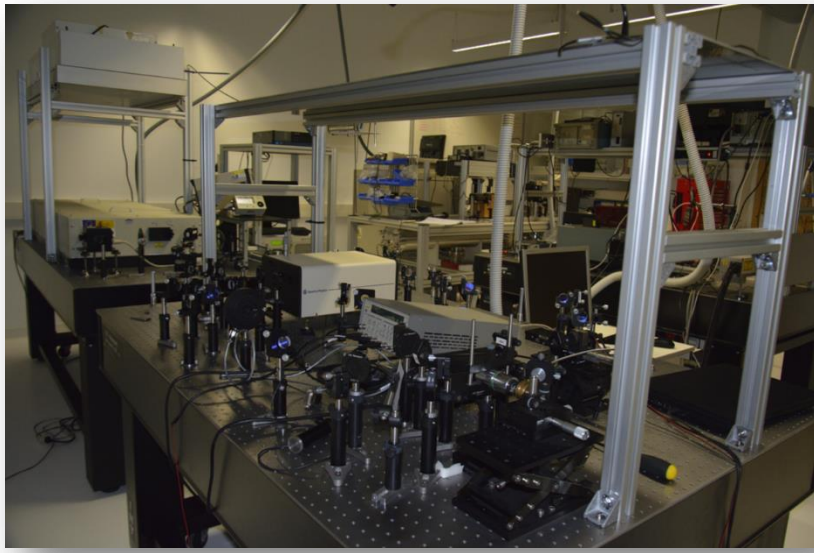
Pedro Jorge [Senior Researcher INESCTEC and Assistant Professor FCUP]

LIBS is a promising tool for real time elemental analysis, especially for low atomic weight critical raw materials such as Li, where traditional techniques are lacking. Leveraged by fast paced technological developments in the laser and detector industry, LIBS is no longer confined to the lab, and is presently addressing the last frontiers from deep sea to spatial exploration. However, field deployment faces serious challenges of stability and reliability. In this context, INSITE team is developing a new generation of LIBS systems, supported by modular hardware solutions, smart software strategies and a reference spectral database, aiming to develop a LIBS ecosystem that can readily be adapted to diverse harsh operational conditions, enabling reliable operation in activities such as mining exploration and exploitation.

Direct analysis of condensed-phase through laser-plasma-based spectroscopic

José M. Vadillo [Department of Analytical Chemistry, University of Málaga]

From close contact analysis to remote determinations; from sub-aquatic measurements to daily data on Mars, laser-based spectroscopies have gained a place within the arsenal of available techniques for direct analysis of samples. Particularly laser-induced breakdown spectrometry, due to the inherent flexibility offered by the technique, has allowed ubiquitous use in an uncountable number of applications covering a diversity of research areas. Some of them - that will be detailed during the talk - have already been demonstrated at UMALASERLAB (University of Malaga), with special emphasis in recent times on those related to the MARS 2020 mission where experiments mimicking the conditions of the red planet are being conducted on the largest thermal vacuum chamber (TVC) available in Europe for stand-off spectroscopies. With its 12-meters length and 1.6 meters of internal useful diameter, the TVC at UMALASERLAB allows the development of experiments in LIBS, Raman, laser-induced fluorescence, as well as the test of subsystems and whole instruments under realistic conditions.



S2	*ONE FOOT ON SEA AND ONE ON SHORE - GO UNDERWATER AND DIVE INTO THE FUTURE OF LIBS AND GEO-TECHNOLOGIES – PART I*

Development of photonic techniques for raw material analysis

Salvatore Siano [Consiglio Nazionale delle Ricerche - CNR]

Some recent results on the development and application of photonic techniques for mineral analysis, which have been achieved by our group will be briefly summarized. These focus on in situ detection of minerals phases, determination of the major and trace elements, systems prototyping, and associated applications. Most of work has been carried out within the framework of upscaling and networking projects of the KIC-Raw Materials, such as InSITE "Insitu ore grading system using LIBS in harsh environments", InnoLOG "Innovative geophysical logging tools for mineral exploration," PIMAS "Portable Instant Mineral Analysis Systems", and related R&D services. In all the cases, the activities have been mainly aimed at fostering the exploitation of the significant potential of laser techniques such as LIBS and Raman spectroscopy for in situ material characterization. Despite the rapid evolution of the solid state sources and sensors along the last two decades favoured the introduction of several portable analytical tools on the market, for most of the potential applications of interest in mining, material processing, recycling, environmental control, precision agriculture, and other, further development efforts are needed in order to address a variety of open problems concerning efficiency and effectiveness, suitable performances, and engineering of novel dedicated instruments.

S3	*ONE FOOT ON SEA AND ONE ON SHORE - GO UNDERWATER AND DIVE INTO THE FUTURE OF LIBS AND GEO-TECHNOLOGIES – PART II*

Fully integrated industrial use of optical measurement methods using the example of LIBS

Joachim Makowe [LSA – Laser Analytical Systems & Automation GmbH]

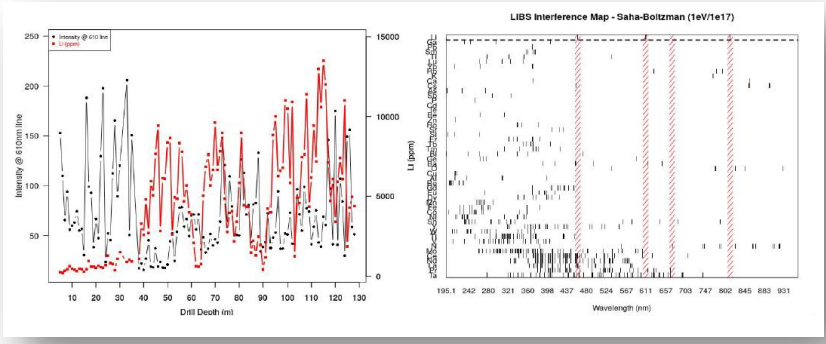
In this presentation, examples of routine industrial applications for inline process control tasks and R&D activities using laser-induced breakdown spectroscopy (LIBS) will be presented. This measurement technique offers the possibility of non-contact and non-destructive analysis, so that control and inspection tasks can be realized in an automated way. The requirements for product and quality assurance in the manufacturing and processing industry are as diverse and varied as the respective products. Raw and primary materials must be inspected before and after delivery as a finished product. Products should be inspected as comprehensively as possible during the manufacturing process so that the production flow, e.g. for quality control, is not impaired or can be adjusted and readjusted if necessary. At the end of this chain is the final inspection of the product before delivery to the customer. As diverse as the tasks are, the measuring method to be used must also be flexible to meet all requirements.

Examples of fully automatic LIBS systems will be shown, each of which has been designed specifically for the customer. The very different fields of application require the adaptation of the key components used to the respective task, which particularly concerns the laser beam sources, detector systems and beam guidance, since the requirements for LIBS analysis are usually very differentiated. For example, for steel analysis, high spectral resolution and detector sensitivity are crucial for detecting the lowest possible element concentrations, whereas for quality control in a production process, the shortest possible analysis time is essential, without significantly affecting production. In addition, the integration into a higher-level process control system, and finally the robustness of the system for 24/7 operation are important.

Strategy for solving LIBS quantitative information in complex samples: lithium quantification in exploratory drilling

Rui Martins [Senior Researcher Applied Photonics Research Center CAP|INESCTEC]

Analytical quality quantification of complex samples is one of the major challenges of LIBS technology. Dealing with systematic intrinsic factors of ablation, plasma physics and chemistry inevitably leads to significant matrix effects, emission interference, and non-linear effects (e.g., self-absorption/reversion, scattering). These effects destroy a direct relationship of emission spectral lines intensity and element or molecular concentration. Three approaches are used for quantitative LIBS: i. Calibration free (CF); ii. Chemometrics (Chemo); and iii. Artificial intelligence (AI). CF methods excel in the quantification of major constituents of simpler samples (e.g., alloys); and Chemo and AI have been chosen for more complex samples, allowing also better results with the major constituents. The most popular Chemo method in LIBS is Partial Least Squares (PLS), which assumes there is a direct correspondence between spectral features (latent variables) to the ground-truth concentration. This principle is broken when samples complexity increases, resulting in underperformance of PLS models. Deep learning (DL) methods are currently a popular choice for dealing LIBS complexity. The major pitfall of DL is i. the necessity of big data and black-box feature extraction, which does not allow to diagnose model causality, and ii. monolithic learning - a new model architecture must be generated for new data. In this research, we present an example of LIBS high-complexity present in a single lithium prospection drilling from Barroso-Alvão pegmatites and discuss/show why the strategy of local geometries in latent variables, to which name 'self-learning', is an efficient way to unscramble and interpret LIBS quantitative information, which can be counter-intuitive - where minerals with higher lithium concentrations show lower lithium lines intensities (image bellow) and spectral interference with other elements.



Lithium quantification: Counter-intuitive lithium lines intensities decrease with hither lithium concentrations and lithium spectral interference with other elements.

Underwater autonomous systems & future trends

Alfredo Martins [Research Coordinator at CRAS|INESCTEC, Professor at ISEP|School of Engineering]

Underwater robotic and autonomous systems are key tools in exploration and in establishing human presence or action in extreme environments such as the deep sea or underground flooded mines. These tools are also emerging as relevant in the mineral and raw materials application areas such as in emerging focus on deep sea mining and the possible exploitation of untapped land mineral resources in a sustainable way.

This presentation will provide a glimpse of the current state of underwater autonomous systems with particular attention with their relationship with raw materials application area. It will briefly address some of the INESC TEC current work in this topic and will also perspective the future trends that are emerging.

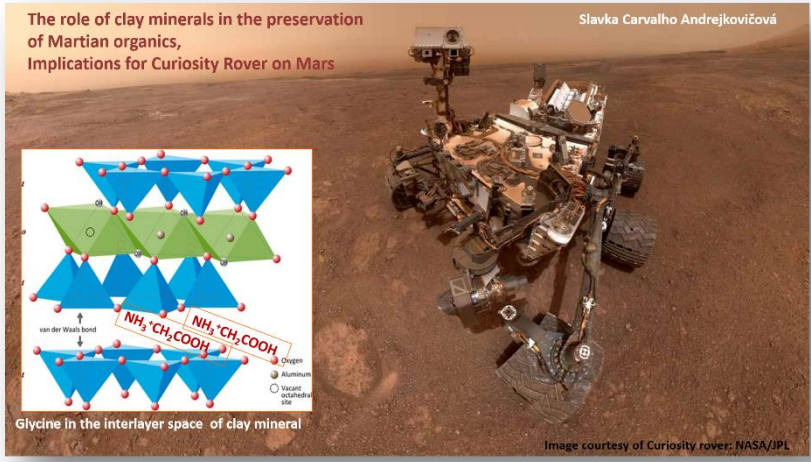
The role of clay minerals in the preservation of Martian organics, implications for Curiosity Rover on Mars

Slavka Carvalho Andrejkovičová [Investigator at GeoBioTec|University of Aveiro and Special External Scientist at NASA Goddard Space flight Center, USA]

The recent Mars rover missions allow to study, for the first time, the habitability conditions and possibility of life on another planet with in-situ data. In the early Earth clay minerals are one of the most likely substrates where organics could have been concentrated. The hypothesis that clay minerals may have preserved organics at Mars, plays a critical role for the origin and evolution of possible life forms on this planet.

In Gale crater, Curiosity rover detected a diversity of clay minerals. Moreover, ancient organic molecules were recently discovered by the Curiosity rover in the top five centimeters of the Martian regolith, despite the current harsh conditions of the Martian surface.

Adsorption of amino acids (one of the building blocks of life) on smectites is relevant to prebiotic processes involving possible catalytic reactions in the early Solar System, as implied by the clay-organic correlation found in meteorites, and the generation and modification of organics essential for the origin of life. Thus, the fundamental question is: Could have been aminoacids preserved by clay minerals on Mars?



Geochemistry Analyses in Planetary Analog Environments

Amy McAdam [Research Space Scientist in the Planetary Environments Laboratory at NASA's Goddard Space Flight Center; SAM team Curiosity ROVER, USA]

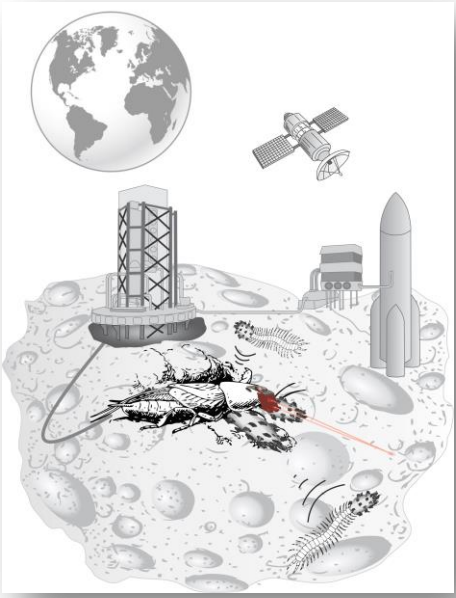
Field campaigns in terrestrial planetary analog environments enable researchers to study natural materials and processes relevant to understanding materials and processes on other planetary bodies. They also enable testing of instrumentation and operations concepts comparable to those which are, or will be, used by robotic and crewed missions to planetary surfaces. Here I will discuss geochemistry analyses carried out during several analog campaigns with a focus on analyses by handheld Laser Induced Breakdown Spectroscopy (LIBS). These analyses, together with field observations and data from other field instruments, helped the field teams to address science questions and provide feedback on the possible use of LIBS technology by astronauts during future crewed missions.

Amy using the handheld LIBS at a field site in the Portillo Volcanic Field, New Mexico, USA.

The vision of the mine of the future

Gorazd Žibret [Geological Survey of Slovenia – GeoZS]

The mining of the future will undergo the paradigm change in the next 30-50 years. Mining industry today is placing its bet on going big - large mines, large production, big machines etc., to cope with the ever-increasing demand for mineral resources, while with the decreasing ore grades in easily access deposits at the same time. Mining according to this paradigm cause unnecessary environmental burdens and land degradation and produces exceptionally large number of wastes. The mine of the future will go towards highly selective precision mining which will take place in environments not suitable for humans, including extra-terrestrial bodies. In the first stages, humans will interact with the machines, but in later stages the whole mining system will be able to operate autonomously. Humans will no longer be needed in harsh and dangerous mine environments, decreasing the costs of life support, and required infrastructure. This will at the same time also enabling mm to m-scale extraction of deposits, which are not economical with the current mining technology today. The INSITE project is a part of this story, developing new instruments for determining rock and ore composition in such harsh mine environments, providing crucial information for any decision systems in mines, whether automatic, or human-based.

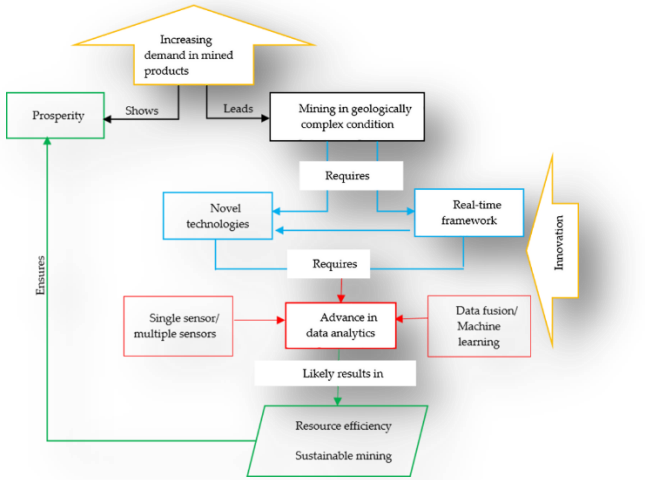


Graphical design: Gorazd Žibret & Vida Pavlica.

Technology and Advanced Data Analytics for Raw Material Characterization

Feven Desta [Delft University of Technology – TUDelft] & Mike Buxton

Global demand for mined products is increasing rapidly, because of population and economic growth. While accompanied by greater prosperity, the rise in demand for mineral resources requires a sustainable supply. A sustainable extraction and production of mined products call for mining process changes and interventions driven by technology and advanced data analytics. This research aims to develop methods for the characterisation of raw materials using laser-induced breakdown spectroscopy (LIBS) and infrared technologies that can be potentially applicable to mining operations. The study involved the mid-wave infrared (MWIR), long-wave infrared (LWIR) and LIBS sensor technologies to acquire spectral information over a wider range of the electromagnetic spectrum. This research demonstrates the potential benefits and opportunities for the use of sensor technologies and data analytics for the discrimination of ore and waste materials and the identification of minerals/elements using samples collected from different deposit types. The use of infrared technologies and LIBS coupled with chemometric techniques allowed the classification of materials at different elemental concentrations. The proposed approach offers the possibility for rapid, accurate and in-situ analysis of materials. Thus, it can contribute to the sustainable and cost-effective extraction of mineral resources.

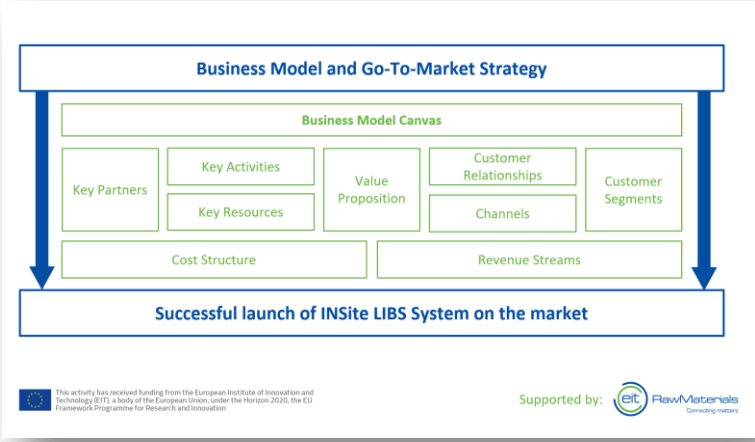


The proposed approach for addressing the rising demand in mined products through technology and advanced data analytics.

Go-To-Market-Strategy of INSite

Tim Kemperdick & David Neuen [Chair of Management Accounting, RWTH Aachen University]

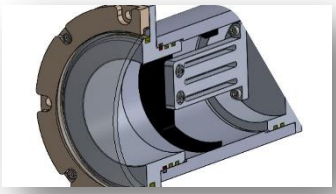
A sound and comprehensive business model and Go-To-Market Strategy is essential to guarantee a successful launch of a new product on a market. The LIBS market is a niche market in comparison to other markets like the XRF market. Nevertheless, the potential of a growing LIBS market by cannibalizing the XRF market is apparent. So far, a LIBS system, which is on the one hand portable and on the other hand capable of accurately identifying and quantifying ore grades is not offered by any supplier. To fill this gap on the market, we analyze together with LSA the crucial requirements having to be fulfilled to bring the LIBS system of INSite into the market. Our business analysis builds upon a Business Model Canvas. The dimensions in the Business Model Canvas include potential customers, market demand, competition, value proposition, distribution channels, key partners, key activities, key resources as well as cost and revenue streams. Potential customers, distribution channels, the value proposition of the INSite LIBS system and the potential market demand has been assessed. Furthermore, we have calculated the economic viability of the project and the LIBS system by identifying the net present value of the total investment based on cost structures and sales estimates derived by three different scenarios of the market potential. Preliminary results suggest that even in a worst-case scenario a positive NPV is feasible. In base-case and best-case scenarios the NPV surpasses 1M € substantially.

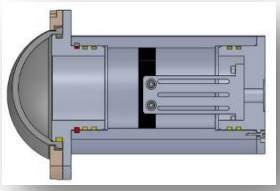


Material selection and mechanical design of housings for smart LIBS employed in underwater mining exploration

Kannaki Pondicherry & Manjunath Manjunath [Department of Electromechanical, Systems and Metal Engineering, Gent University - UGent]

Underwater smart LIBS used in deep-sea applications often require housings capable of withstanding high hydrostatic pressures depending on the operating depths. In addition to difficulties encountered in creating an appropriate mechanical design, finding suitable material with required pressure resistance, lightweight, and ease of manufacturing is a challenging task. Material selection was done by doing experiments on the study of the robustness to elements of abrasion and corrosion, using a customised tribometer, as it is noteworthy that tribo-corrosion is the expected mode of material loss. Material testing was performed on three potential candidates: stainless steel, Al-6061, and Ti6Al4V. Mechanical design of the housing addressed major challenges such as portability of the system with robust cover for geological applications. The housing is designed strong and stiff enough to withstand hydrostatic pressures. Iterative FE simulations are performed on the housing wherein compressive loads are induced to 1) obtain the optimum dimensions and 2) check the material stability. The housing design also includes a transparent window and appropriate end-enclosures that not only ensure sealing but also enable the various electronic cabling connections. Finally, a rugged housing for the smart LIBS product enabling its operation in harsh underwater mining environments was designed at UGent.



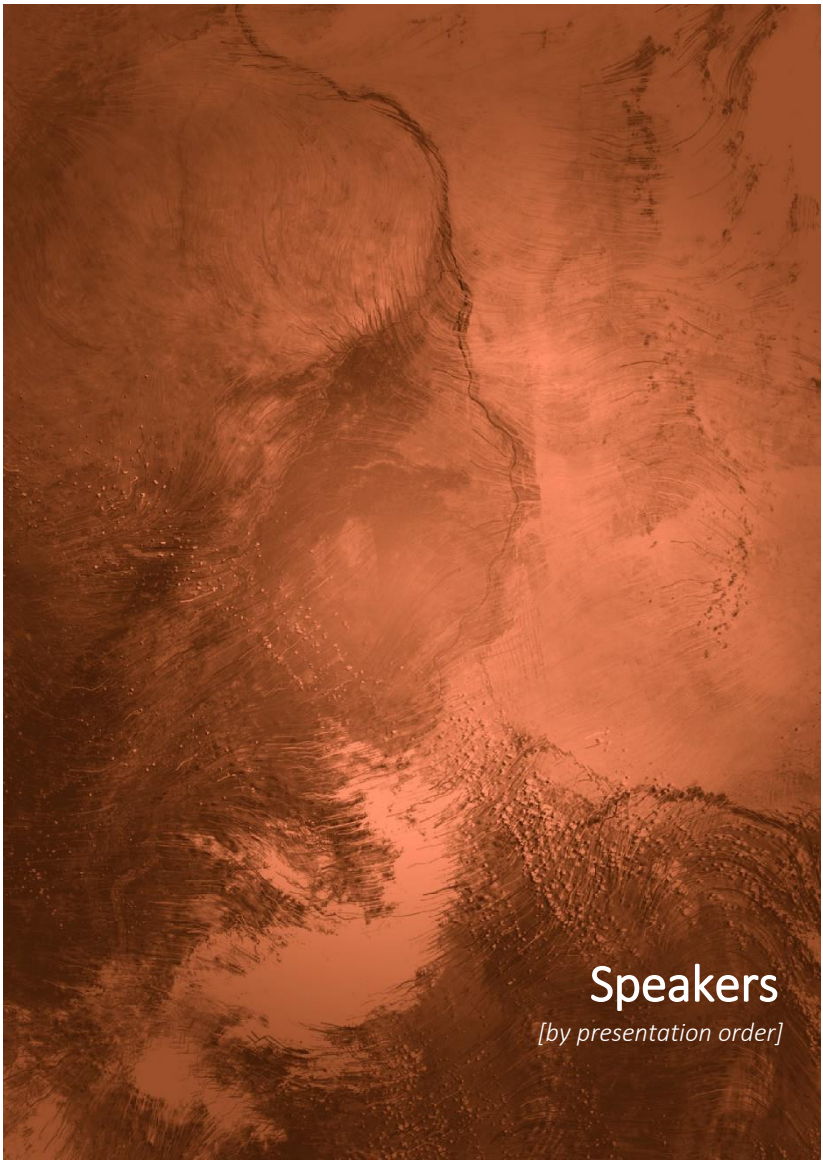


WU	*WRAP-UP AND CONCLUSIONS*

WRAP-UP and CONCLUSIONS inSITE Workshop
Pedro Jorge [Senior Researcher INESCTEC and Assistant Professor FCUP]

CS	*CLOSING SESSION*

"IN THE BLACK" AND THE "PORTUGUSE" RAW MATERIALS WEEK
Eduardo Silva [TEC4SEA Coordinator, Researcher at CRAS|INESCTEC]



Speakers

[by presentation order]

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José M. Vadillo (B.S. Biology, PhD Analytical Chemistry) holds a Full Professor position at the Department of Analytical Chemistry at the University of Málaga. He has developed his scientific career in the field of analytical microprobes with special emphasis on laser-based microprobes (laser-induced breakdown spectrometry and laser-ionization mass spectrometry) and secondary ion mass spectrometry. A significant part of his trajectory has been focussed on the understanding of laser-matter interaction in the femtosecond regime by means of ultrafast pump-probe microscopy.

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Research activity focused on the development, validation, and transfer of laser, optoelectronic, X-ray, and neutron techniques for material characterisation and processing. Specific applications include diagnostics and conservation of cultural heritage, mineral exploration, industrial processes, biomedical research, and other.

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Mr Makowe studied physics at the University of Tübingen, Germany, and investigated shock processes in absorption spectra of thin gases using a semiconductor laser in his diploma thesis. He subsequently completed his PhD thesis at the Département de Chimie of the École Polytechnique Fédérale de Lausanne, Switzerland, he worked on the laser isotope separation of silicon using various laser-based molecular and mass spectroscopic methods. In 2002, he moved to the department of laser measurement technology at the Fraunhofer Institute for Laser Technology in Aachen and was responsible for various R&D projects in the field of laser emission spectrometry. In 2004, he founded the company LSA - Laser Analytical Systems & Automation GmbH and has been a partner and managing director ever since.

Rui Costa Martins

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Rui Costa Martins obtained his Ph.D. in complex systems (Bioengineering/Food) in 2004, from the Catholic University of Portugal. He holded Post-docs positions on Chemometrics, Biosystems Engineering, and BioPhotonics, and since 2006 he has specialized in developing advanced intelligent photonics sensors and systems. He was an auxiliary researcher at the University of Minho (2008-2015). Since 2016, he is a senior researcher at the Applied Photonics Research Center – INESC TEC, leading the development of intelligent photonics sensors and consolidating high-end spectroscopy POC reagent-less technology for clinical analysis and medical diagnosis, precision agriculture and plant biotechnology, biotech/food industry and raw materials. He is also a highly prolific inventor in the field of "intelligent photonics sensor systems", author of a significant number of scientific publications, communications, and scientific prizes.

Alfredo Martins

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Alfredo Martins is currently a Professor with the School of Engineering (ISEP), Porto Polytechnic Institute (IPP), and a Research Coordinator with the Robotics and Autonomous Systems Group, INESC TEC, Portugal.
He currently participates in various international EU and H2020 (EU-Scores, Atlantis, UNEXUP, Nettag) and national deep sea (Nessie, Hypersea) marine robotics research projects.
He has a vast experience in mobile robotics, having worked with autonomous robots, since 1993, in multiple international (NATO, EU FP7, H2020) and national research projects addressing search and rescue, security, environmental monitoring, underwater mining and marine and deep sea robotics.
With an extensive list of publications in both land, aerial, underwater, and surface autonomous robots, his research interests include the perception, navigation, control, and coordination of mobile robots with particular emphasis on marine robots.

Slavka Carvalho Andrejkovičová

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Since November 2019, Dr. Slavka Carvalho Andrejkovičová works as a Principal Investigator at GeoBioTec – UA and as a Special External Scientist for NASA Goddard Space flight Center (USA). In 2020 she became a collaborator of the New Goddard Center for Astrobiology at NASA Goddard Space Flight Center (USA).
From January 2016 to July 2019, she was a Research Scientist on the Mars Science Laboratory (MSL, better known as the Curiosity Rover on Mars) team at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (USA). During this period, she was also Assistant Researcher in the Department of Astronomy at the University of Maryland (USA). Previously, from July 2009 to December 2014 she was an Assistant Researcher in the Department of Geosciences at the University of Aveiro under the program of the Foundation for Science and Technology (FCT) Science 2007, and from 2003 to 2009 she was a PhD Researcher at the Instituto de Inorganic Chemistry at the Slovak Academy of Sciences, Bratislava, (Slovakia). In 2008 he obtained his PhD in Inorganic Technology and Materials. Dr. Slavka Carvalho Andrejkovičová also has a Bachelor's Degree in Chemistry obtained in 2001 and a Master's Degree in Chemistry (specialization in Nuclear Chemistry and Radioecology) obtained in 2003 at Comenius University in Bratislava, Slovakia.

Areas of expertise and research: Geochemistry of clay minerals and clays, environmental applications of chemically modified clay minerals; Adsorption of heavy metals by clays - Influence of different organic solvents on the swelling properties of organo-modified clays; Adsorption of organic dyes in clay minerals, photocatalysis; Air lime mortars with metakaolin, air lime mortars with additions of sepiolite, palygorskite and zeolite for the rehabilitation and conservation of buildings and historical patrimony; Geopolymers based on recycled industrial waste for civil engineering and polluted water depollution applications; Preparation of samples similar to Martian materials based on clay minerals and perchlorates, and their characterization through various techniques (XRD, EGA, FTIR) for validation of data measured in situ in Martian samples by rover Curiosity; Habitat study and past life search and / or survivor on Mars

Amy MacAdam

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She is a research scientist in the Planetary Environments Laboratory at NASA's Goddard Space Flight Center. Her primary research emphasis is on investigating the mineralogy and chemistry of planetary materials and their analogs to better understand geologic and environmental history, and habitability. She uses a variety of approaches, including studies of planetary mission data, analyses of analog materials in the laboratory and in the field, geochemical modelling, and involvement with development of new geochemistry instrument concepts. A major focus of her work for more than a decade has been preparation for, followed by involvement in, the Curiosity rover mission.

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Dr. Gorazd Žibret, born in 1977, is a geologist, employed at Geological Survey of Slovenia. He leads the Mineral Resources programme group and is a member of Raw Materials Supply Group, which is a consulting body for the European Comission. His research interests are related to the determination of environmental impacts of past and present mining and distinguishing natural and man-made anomalies in such environments. He is also a licenced surface mine designer, technical leader of surface mining and mine project evaluator (all geological part) according to the Slovenian legislation. His passion is use of machine learning and artificial intelligence for data mining and processing of geological datasets. He has participated in 12 different international projects related to various aspects of mining, and has published 178 bibliographical units, including 29 original scientific articles, 1 review article, 2 short scientific articles and 5 scientific book chapters.

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Feven Desta is a postdoctoral researcher at Delft University of Technology (TUD). Her research was focused on investigating the use of sensor technologies and data fusion for the characterization of materials in mining. She has a BSc degree in Geology, an MSc degree in Geoenvironmental systems analysis and an MSc degree in Geo-information science and earth observation (Major: Geoinformatics). Feven completed her PhD at TUD. Her PhD topic is "Sensing and data fusion opportunities for raw material characterisation in mining". Prior to TU Delft, she worked at different companies in the area of Geosciences. Feven is currently involved in the project entitled "In situ ore grading system using LIBS in harsh environments – INSITE".

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Manjunath was born in Koppal, India. He completed his bachelor's degree in Mechanical Engineering at Visvesvaraya Technological University (VTU), Belgaum, India and received the degree in Bachelor of Engineering in July 2015. After that, he pursued M.Tech in Mechanical Engineering with a specialization in Machine Design from the People's Education Society University (PES), Bangalore, India. He graduated in 2017 with a thesis on "Design and Development of Engine Valve Train Wear Test Rig" in collaboration with Tianhe Chemicals Group Ltd and Chemizol Additive Private Limited. He then worked for about two years until 2019 as a Product development engineer in Ducom Instruments, where he builds machinery for tribological applications and life assessments of mechanical components.
Later, he started his doctoral research at the Department of Electromechanical, Systems and Metal Engineering, Ghent University in 2020 under the guidance of prof. Patrick De Baets and prof. Dieter Fauconnier with the thesis titled, 'Design and instrumentation of novel larger scale TEHL bearing test rig'. In his PhD, he is working on the construction of bearing test rigs and advanced lubrication systems for bearings health monitoring and operational characteristic. As part of his PhD, he is also working on the development of micro-scale sensors (micro-transducer & optic fibres) with the Department of Photonics and Applied Physics (TONA) of the Faculty of Engineering at the Vrije Universiteit Brussel (VUB). Addionally, he is also working on the development of surface profilometer, test-setup for horseshoes simulator and agriculture automation projects within the collaboration of Flemish make industries. His core research area is in innovative larger-heavy machinery constructions, working with multidisciplinary technical teams to develop innovative products and industrial project management.

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Kannaki Pondicherry is from Hyderabad, India. She completed her bachelor's degree in Metallurgy and Materials Technology from Mahatma Gandhi Institute of Technology (MGIT), Hyderabad, India and received the degree in Bachelor of technology in May 2009. After that, she pursued M.Tech in Metallurgical Engineering and Materials Science with a specialization in Steel Technology from the Indian Institute of Technology, Bombay (IITB), Mumbai, India. She graduated in 2012 with a thesis on “Tribological studies of bearing steels”. She then worked for about a year and half as a lecturer until 2013 in a polytechnic engineering college, Rajiv Gandhi Institute of Steel Technology, Bellary, India, during which she had an opportunity to teach young undergraduate students various metallurgical subjects. In 2014 she joined her alma mater, Mahatma Gandhi Institute of Technology, Hyderabad as an assistant professor. Later, she started her doctoral research at the Department of Electromechanical, Systems and Metal Engineering, Ghent University in 2014 under the guidance of prof. Patrick De Baets and prof. Dieter Fauconnier with the thesis titled, ‘Two-body abrasion and synergy in abrasion-corrosion of martensitic and complex phase steel’. This research work was carried out in the framework of MaDurOS program and has been financially supported by SIM-vzw, Flanders and VLAIO, Flanders. She has authored three scientific articles and co-authored three in international peer reviewed journals (Q1 and (Q2) in addition to presenting her research work in several national and international conferences of repute in field of Tribology. Presently, she is continuing as a post-doctoral researcher at Soete laboratory, Ghent university and in involved in inSITE as a materials engineer to enable material selection for underwater pressure housing.

NOTES

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