Meet the researcher

Interview with Elison Matioli, Brazilian ERC starting Grant awardee

Elison Matioli is a tenure-track assistant professor and director of the POWERlab at Ecole Polytechnique Fédérale de Lausanne (EPFL) in Switzerland.

He received undergraduate degrees from Ecole Polytechnique in France (2002) and Escola Politécnica - USP in Brazil, followed by a Ph.D. degree at the University of California, Santa Barbara and post-doc at the Massachusetts Institute of Technology (MIT).

He has received the Outstanding Graduate Student - Scientific Achievement Award for his Ph.D. thesis and the IEEE George Smith Award for his demonstration of high-efficiency nanostructured power electronic devices.

His laboratory develops new semiconductor concepts based on nanostructures applied to high-performance materials to drastically improve the efficiency in energy conversion.

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You have recently been awarded an ERC Starting Grant. Could you tell us about the research you are conducting with this grant? How can the general public benefit from it?

My research is in the field of energy, focusing on developing new technologies to allow much more efficient energy conversion systems.

It is clear that the rapid increase in energy demand and carbon dioxide emissions represent a huge challenge, which can be addressed not only by producing more energy from renewable sources, but also by wasting less with energy-efficient systems.

One of the major sources of losses is related to electric power conversion (such as AC-DC, DC-AC, voltage and current levels), from the electricity generation, transmission, all the way to its consumption. Power conversion is present in nearly every electric system (computers, home appliances, etc..) wasting around 15% of all the electricity consumed in the world. This represents around 3000 TWh, which is a huge amount of energy (in comparison, the largest hydroelectric power plants in the world, such as the three gorges in China or Itaipu in Brazil, produce about 100 TWh per year).

My ERC-funded project, called **In-Need**, proposes new electronic power devices (transistors and diodes) characterised by much higher efficiency with significantly reduced size, increased power density and improved thermal management that could lead to a reduction of more than 50% of the losses in power conversion.

How did you find out about the ERC selection process? Can you share any tips with our readers on how to apply for an ERC grant successfully?

The ERC grants are very prestigious in Europe. After my arrival at EPFL as a faculty member, I was informed about the application process, and was strongly encouraged to apply. I have dedicated a significant share of my first months as professor at EPFL to prepare my ERC application, which turned out to be very well invested time.

My recommendation for a successful application is to start preparing for it well in advance, gathering all your ideas, developing them further, and getting the opinions of your peers. Remember that this is a high-risk high-gain grant, this means that projects showing small advancements of the state-of-the-art are unlikely to be selected.

You have studied in Brazil and in the USA and are currently working in Europe. Could you tell us more about your research career so far? How has mobility influenced the direction of your career?

I started my undergraduate studies in Brazil, in electrical engineering at the Escola Politécnica of University of São Paulo. In the middle of my studies, I was admitted to Ecole Polytechnique in France, to pursue a double diploma as undergraduate student in Applied Physics and Mathematics.

After finishing both degrees, I pursued a Ph.D. degree in Materials Science at the University of California, Santa Barbara, where I worked in the field of LEDs for lighting applications, together with the 2014 Physics Nobel Prize laureate, Prof. Shuji Nakamura. Then, I went to the Massachusetts Institute of Technology (MIT), as a postdoctoral fellow in the Electrical Engineering department, to expand my knowledge to the field of power electronics.

My education in these different fields, from Electrical Engineering, Applied Physics and Mathematics, to Materials Science, is fundamental to the research that I carry on now as it combines elements of each of these subjects to address energy challenges.

The experience of living in different countries allowed me to learn several cultures, languages, educational systems, to take the best aspects of each and incorporate them in my own research and teaching. This is very important in my current function, as I have Ph.D. students from all over the world in my group, and I teach classes in both French to undergraduates and English to graduate students at EPFL.

I believe that, just as I benefited from an international career path, it is very important for any researcher to be exposed to different environments.

To what extent is scientific cooperation taking place between Europe and Brazil in your area? How important and valuable is this cooperation?

As far as I am aware, the current collaboration between Brazil and Europe in my field is not yet at the level that it could be.

I believe that stronger cooperation between European and Brazilian universities could be very enriching for scientific research in both regions. Such cooperation also opens new opportunities for young Brazilian researchers to experience research abroad and to be exposed to different ways of thinking and cultures, which ultimately can have a significant impact on the scientific research in Brazil.

This is particularly important in the field of research I am engaged in. Increasing and improving collaboration with top European institutions can strengthen Brazilian research in this area which is of strategic importance for any country.

In your opinion, what could be done to further enhance the mobility of international researchers between these two regions?

I think the main reason preventing the mobility of researchers between these two regions is that knowledge of the research performed in each of these regions is only partially shared. The limited cooperation schemes and funding available is also a factor.

To further enhance the mobility of researchers, I believe that more grant schemes could be offered for the top postdocs and Ph.D. students to come to European research institutions, and more opportunities to share research results between these two regions could be created, in addition to specific funding calls for collaboration between Brazilian and European universities.

CONFAP and ERC recently signed an implementing agreement to encourage young Brazilian scientists to join ERC-grantees' research teams in Europe for a short-term period. How can this opportunity benefit these Brazilian researchers' careers and Brazilian science at large?

This initiative will certainly enrich Brazilian science. It creates more opportunities for young Brazilian researchers to come to Europe and join ERC-funded projects for a limited period of time.

Most of these young researchers will go back to Brazil and implement some of the ideas and methods experienced abroad. Others may remain abroad but this is also very valuable as it opens opportunities for future collaborations with other Brazilian researchers.

In your opinion, what is the best aspect of the European research community?

The best aspect of research in Europe is its vast network of world-class researchers in all kinds of fields from institutions based in different countries, collaborating amongst them through various grant schemes.