2 PhD positions on Advanced and Green magnetic materials at the IMEM Institute

Two PhD positions are available in the Institute of Materials for Electronics and Magnetism of the Italian Research Council in Parma, Italy (www.imem.cnr.it). The PhD degree will be developed in the framework of 28th PhD School on Science and Materials Technology organized by the University of Parma in Italy.

1st PhD position: **Development of new materials for sustainable magnetic inks with multifunctional properties**

The scientific and technological scopes of the thesis are focused on the development of novel magnetic materials for anti-counterfeiting and anti-theft applications. In particular, the thesis will concern the synthesis and study of new magnetic particles with optimized properties for the production of innovative sustainable inks. The thesis will be developed in direct collaboration with the Italian company EPTAINKS (https://www.eptanova.com/it/eptainks), leader in the production of inks, mainly employed for industrial printing. The work will take place in direct contact with the industrial reality, there are internships in the company for a total minimum period of 6 months.

The research concerns first developments in the sustainability of these materials and secondly the development of multifunctional performances. The PhD student will develop skills in the synthesis of micro and nanomaterials, in characterization techniques and in the study of chemical and physical properties. He/she will also develop skills on magnetic properties and magnetization mechanisms. In addition, he/she will develop skills on the technological transfer of knowledge from laboratory to industry.

2nd PhD position: **Development of hybrid recycled permanent magnets**

The purpose of this PhD thesis is the development of a new type of permanent magnet with low rare earth content and from the recovery of recycled magnets. Permanent magnets are key components of wind turbines and Green electrical vehicles. The research on novel permanent magnets without critical materials, in particular rare earths, is considered one of the main challenges for the Energy Green Transition[1-3]. In fact, the thesis will be developed in the framework of the European project INSPIRES, Intelligent and Sustainable be Processing of Innovative Rare-Earth magnets (www.inspires-magnet.eu) funded by the European Institute for Innovation and Technology- Raw Materials. This project involves several research institutions, universities, and industries from 6 European countries working and producing permanent magnets.

The research will develop a hybrid magnet of intermediate performances (Energy product >40 kJm-3) by combining powders of NdFeB and Strontium Ferrite from recycled magnet. Several mechano-physical procedures will be explored to induce the magnetic coupling between the two phases. Also new procedures for the production of magnets with low energy consumption be developed. The PhD student will get expertise in the characterization techniques employed for the study of magnetic materials and also magnets, and in the procedures for recycling and production of permanent magnets.

[1]. "European Commission, Study on the EU's list of Critical Raw Materials – Final Report (2020)" [2]. "European Commission, Critical materials for strategic technologies and sectors in the EU - a foresight study, 2020" [3]. See arma.eu website

Information:

Public enrollment selections are held at the University of Parma, for qualifications and exams. The information on this Call is available in the website: https://www.unipr.it/en/doctoral-doctoral-enrollment.

The deadline for the registration is the 2nd September 2022at 13,00.

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