

I+D+i IN SCIENCE & TECHNOLOGY OF MATERIALS AT UNESC (BRAZIL)

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Abstract: The Universidade do Extremo Sul Catarinense (UNESC) is a community institution of higher education that carries out teaching, research and extension activities to promote socioeconomic development in its area of coverage. With the mission "Educate, through teaching, research and extension, to promote the quality and sustainability of the living environment", UNESC has been working for 55 years for regional development, through basic training to postgraduate studies, distributed in more than 15 thousand students, qualified research carried out in research groups and stricto sensu postgraduate programs, community extension and service provision and stimulating innovation and entrepreneurship.

Keywords: Community University, UNESC, teaching, research, extension, innovation

1. INTRODUCTION.

The Universidade do Extremo Sul Catarinense (UNESC) is a community higher education institution that plays a key role in the educational, scientific, technological and socioeconomic development of the southern region of the State of Santa Catarina, Brazil. Founded with the aim of providing access to higher education of excellence, and having as its mission "*To educate, through teaching, research and extension, to promote the quality and sustainability of the living environment*", UNESC has consolidated itself over the years as a reference in quality of teaching, research, extension and innovation.

Community universities are non-profit higher education institutions that reinvest their financial results in the maintenance of their activities. They are universities that contribute to the development of Brazil by offering quality education, conducting research, community outreach activities, providing technological services, encouraging innovation and carrying out actions on their own initiative or in partnership with the productive sectors and public authorities, with the aim of promoting regional development.

The university, maintained by the Criciúma Educational Foundation (FUCRI), acts as a community institution, harmoniously integrating teaching, research and extension activities for the benefit of the local community. With more than 12,000 students in various areas of knowledge, from elementary school to postgraduate level, UNESC stands out for its programs to stimulate research and innovation.

Its undergraduate courses are diversified, covering different areas of knowledge, such as health, applied social sciences, education and science and technology. Currently, it has 77 undergraduate courses, 40 of which are offered face-to-face and another 37 at a distance or semi-presentially [1]. The institution has the highest

score (5) in the Ministry of Education (MEC), which attests to the quality of education offered in Brazil.

UNESC maintains a strong link with the community through its extension activities. Extension projects involving professors and academics extend to several municipalities in the region, addressing issues of social, cultural and environmental relevance. Through these initiatives, the university encourages academic involvement in the discussion and resolution of community demands, promoting local development in a sustainable manner. Numerous activities in the health area are carried out in its Integrated Clinics. The Integrated Clinics have as their mission the assistance, teaching and research in health sciences. In the Integrated Clinics, several types of services are offered to the community, totally free of charge, such as biomedicine, psychology, nursing, pharmacy, physiotherapy, medicine, nutrition and dentistry services, among others. There are about 150,000 annual visits. The Solidarity Pharmacy, for example, is a non-profit initiative that encourages the spirit of generosity among people, through the free delivery of unused medicines to be distributed to the needy population, also free of charge. Colégio UNESC is an integral part of the university and offers basic education, from elementary to high school. Students enjoy a wide structure and have access to the university's resources and laboratories, providing a complete academic education, combining cultural, sports and scientific knowledge.

The UNESC Innovation Agency promotes the articulation between the university and society, seeking to raise funds and transfer technology for regional and sustainable development. In addition, UNESC International works to promote partnerships and exchanges with foreign institutions, broadening the perspective of academics and promoting the internationalization of the institution.

UNESC's Scientific and Technological Park (Iparque), is one of the largest initiatives of its kind in Santa Catarina and demonstrates the institution's commitment to innovation and technological development. Through its institutes and laboratories, UNESC offers technological, laboratory and R&D project development services to companies and institutions from all over Brazil, stimulating scientific research and contributing to the training of new professionals, as well as to regional development and the improvement of quality of life. This region is home to a diversified industrial park, with emphasis on sectors such as ceramics, plastics processing, paints and resins, clothing, metal-mechanics, and coal mining, among others. This diversity places the region in a prominent national position, not only for the quantity produced, but mainly for the quality of the products and services offered. For example, the south of Santa Catarina accounts for about 70% of the national production of plastic packaging and concentrates one of the main ceramic poles in the country, focused on coatings, tiles and bricks. In addition, Criciúma is considered an important health hub, with four hospitals, dozens of specialized clinics and clinical analysis laboratories, serving a population of over one million inhabitants.

Scientific research is a fundamental pillar at UNESC. The university encourages and strengthens the development of research in various areas of knowledge, contributing to the advancement of science and the improvement of life in society.

Since 1999, UNESC has invested in research, through the granting of scientific initiation scholarships and the promotion of basic and technological research, making scientific-technological research an integral part of the regular activities of its teachers. Currently, the university is among the top three higher education institutions in Santa Catarina in terms of research and innovation, according to the University Ranking Folha - RUF, a result of the university's consistent investment in research, especially through its research groups and stricto sensu postgraduate programs.

As for stricto sensu graduate studies, UNESC has 8 postgraduate programs, PPG's: Graduate Program in Health Sciences (PPGCS), Graduate Program in Collective Health (PPGSCol), Graduate Program in Materials Science and Engineering (PPGCEM), Graduate Program in Environmental Sciences (PPGCA), Graduate Program in Socioeconomic Development (PPGDS), Postgraduate Program in Law (PPGD), Postgraduate Program in Education (PPGE) and Postgraduate Program in Productive Systems (PPGSP), the latter in association with the University of Planalto Catarinense (UNIPLAC), University of Contestado (UNC) and University of Joinville Region (UNIVILLE). There is also the offer of lato sensu postgraduate courses (MBA and specialization). According to the CNPq database, there are 101 research groups registered by UNESC. CAPES, Coordination for the Improvement of Higher Education Personnel, linked to the Ministry of Education (MEC), regulates, evaluates and promotes postgraduate studies in Brazil.

In the last CAPES evaluation, 2 PPG's maintained the grade 3 (PPGSCol and PPGSP), 4 achieved the grade 4 (PPGCEM, PPGD, PPGDS and PPGE), 1 PPG increased its grade to 5 (PPGCA) and PPGCS achieved the maximum grade (7, excellence).

2. PPGCEM

Materials are essential and strategic elements for the technological, economic and sustainable development of a modern society and integrate the most different areas of knowledge. The demand for new materials that meet the most diverse requirements is growing and, therefore, the training of new professionals capable of acting with excellence in this segment becomes preponderant.

The graduate Program in Materials Science and Engineering (PPGCEM) is an outstanding example of UNESC's successful research efforts. Created in 2010, the program offers master's and doctoral degrees in the concentration area of Materials Technology. There are 2 lines of research: Development and Characterization of Materials and Waste. The PPGCEM has achieved commendable results, collaborating with several companies in Santa Catarina and carrying out projects in areas such as valorization of coal waste, development of new organic materials for organic light emitting diodes (OLEDs) and solar cells, synthesis of semiconductors and quantum dots from coal waste for photovoltaic cells, development of alumina internal valve coating, catalytic degradation of emerging contaminants present in water and wastewater, and synthesis and functionalization of low-toxicity superparamagnetic magnetite nanoparticles for cancer treatment by magnetic hyperthermia.

The course has master's and doctoral scholarships granted by public bodies, such as CNPq (National Council for Scientific and Technological Development), linked to the Ministry of Science, Technology and Innovation (MCTI), CAPES and FAPESC, Foundation

for Research and Innovation Support of the State of Santa Catarina. To apply for the scholarship, both for the master's and doctoral courses, the candidate must go through a selection process, in March of each year, which consists of a written evaluation, interview and presentation of projects on dates disclosed on the program's website. However, the interested party can join at any time through the continuous flow modality. In this modality, the candidate is submitted to a special evaluation process.

All training and research activities of the PPGCEM take place at Iparque, which has, among others, the following laboratories: Materials Laboratory I (LaMat I) for processing ceramic, metallic and polymeric materials; Materials Laboratory II (LaMat II) for materials characterization; Waste Valorization Laboratory (LabValora); Laboratory for the Development of Antimicrobial Materials (LADEBIMA); and Technical Ceramics Laboratory (CerTec).

PPGCEM has 2 lines of research:

1) Materials development and processing

This line of research seeks to develop technical-technological solutions to meet the demands of industries and society through:

- research into new raw materials or identify alternative raw materials for industrial use;
- development of new technologies and/or improvement of existing ones for materials processing to increase production performance;
- investigation of the most relevant factors of a given manufacturing process, correlating them with the properties of the products, seeking the continuous development, optimization and improvement of the same;
- research into new compositions and forms of processing that optimize final properties and reduce the use of raw materials and energy in the manufacture of products for use in civil construction (ceramic tiles, roof tiles, bricks and glazes, among others);
- development of advanced ceramics with antimicrobial properties;
- development of special glasses, glass-ceramics and bioceramics for applications in the areas of dentistry, biotechnology, microelectronics, ballistics, wear-resistant coatings, among others;
- synthesis and characterization of conducting, semiconducting, piezoelectric, magnetic polymeric materials;
- development of polymers with bactericidal and/or fungicidal properties for application in sensors, biosensors, photovoltaic systems, medical-hospital devices;
- synthesis and characterization of polymeric membranes for use in fuel cells;
- preparation of polymer matrix nanocomposites via incorporation of metallic nanoparticles;
- evaluation and optimization of composition and processing parameters in the production of polymeric materials and polymer matrix composites;
- assessment of possible genotoxic and/or cytotoxic damage caused by chemical agents involved in an industrial process.

2) Waste

This line has as its general objective the use of the waste recovery methodology to promote the circularity of production processes, through:

- identifying new business opportunities and stimulating entrepreneurial practices associated with environmental issues;
- implementation of measures that promote the competitiveness of enterprises, typically through the use of quality and environmental systems, promoting sustainable development;
- inertization of industrial waste, using them in the production of glass and glass-ceramic artifacts;

- development of materials with properties suitable for use as inputs, replacing the use of natural raw materials for the chemical industry and materials from waste;

- improvement of processing techniques for polymers and composite materials containing waste in their composition;

- evaluation of possible ecotoxicological and genotoxic effects of materials produced from waste;

- development of recycled materials with properties suitable for use in civil construction.

3. III SIMPÓSIO DE MATERIAIS E SUSTENTABILIDADE E III CURSO DE INTRODUÇÃO A REOLOGIA

The III Symposium on Materials and Sustainability and III Course on Introduction to Rheology, held on November 28, 29 and 30, 2022, at the University of the Extreme South of Santa Catarina (UNESC), were events of great relevance in materials science and engineering. Organized by the Postgraduate Program in Materials Science and Engineering (PPGCEM) of UNESC, with financial support from FAPESC and the Regional Council of Engineering and Agronomy of Santa Catarina (CREA-SC), the symposium and course brought together leading professionals in their fields.

The III Materials and Sustainability Symposium had 158 participants and 12 speakers, 2 of whom were international speakers, and promoted discussions on new technologies and products developed through Science, Technology and Innovation (ST&I) in the chemical, mining and materials areas, covering metallic, polymeric,

ceramic, composite and cementitious materials. National and international lectures and panels enriched the event, providing key insights and knowledge to drive sustainable advances in these areas.

At the same time, the III Course on Introduction to Rheology provided a theoretical and practical approach to the basic concepts and environmentally friendly technological applications of the science of Rheology. The course, already in its third edition, had the collaboration of several renowned institutions, such as the Instituto de Cerámica y Vidrio de Madrid (ICV/CSIC), the Universidade Federal de Santa Catarina (UFSC), the Instituto de Pesquisas Energéticas e Nucleares (IPEN) and the Universidade Federal do ABC (UFABC), strengthening its relevance and reach.

Both events offered a favorable space for sharing knowledge, exchanging experiences and establishing partnerships between professionals, researchers and students, who had the opportunity to connect and collaborate for the advancement of materials science and engineering in the context of sustainability.

With the quality of the presentations and the active participation of those involved, the III Materials and Sustainability Symposium and III Introduction to Rheology Course at UNESC successfully fulfilled their objectives, reinforcing the institution's commitment to

promoting scientific and technological advances and disseminating relevant knowledge to the world.

4. CONCLUSIONS.

For 55 years, UNESCO has exercised its social function through teaching, research, extension, the provision of technological services and the promotion of innovation and entrepreneurship to promote regional development. As a non-profit institution, its investments aimed at fulfilling its mission have made it one of the leading national non-state institutions in research and innovation. Having consolidated its regional and national relevance, it has the challenge of expanding its partnerships towards internationalization.

5. REFERENCES.

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