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Renewable Materials Development

Abstract: Environmental awareness has led industries and consumers to replace products derived from oil resources with products derived from natural sources. In the case of the composite materials industry, the replacement of synthetic fibers with natural fibers has increased in recent years. Natural fibers are biodegradable, highly available, inexpensive and have mechanical properties that can be compared to those of synthetic fibers. The mechanical behavior of composites is affected by various factors, such as the length, orientation, shape of the fibers, etc. To study the influence that different types of natural fibers and different textile manufacturing techniques have on the mechanical properties of composites, bio-based epoxy matrix composites reinforced with different natural animal fibers were produced, some reinforced with sheep's wool and others with dog wool, which were later subjected to bending and tensile tests. The textile structures used as reinforcement were created using crochet, knitting and weaving techniques. Prior to the composites production, the fibers were characterized by X-ray Diffraction (X-RD), and the yarns produced from these fibers were subjected to tensile tests. The results obtained suggests that the number of yarns and the diameter of the needles used during the production of the reinforcement have a significant impact on the mechanical properties of the composites. The composites reinforced with sheep's wool exhibit higher values of flexural strength, tensile strength, and Young's modulus than those reinforced with dog wool. It was also possible to verify that the composites reinforced with woven fabrics and crocheted fabrics exhibit the highest values of tensile strength, flexural strength, and Young's modulus. Additionally, the composites reinforced with woven fabrics exhibit the highest values of deformation at first failure/ break.

Keywords: animal fibers, dog wool fiber, sheep wool fiber, green composites, mechanical properties

Biography:

Prof. André was graduated in Mechanical Engineering (1999), specialized in mechanical design, completed his MsC in Biomedical Engineering (2005), Medical Devices Design, and completed his PhD in Biomedical Engineering (2005), also devoted to Medical Devices Design. He is an integrated researcher at Centre for Mechanical and Aerospace Science and Technology (www.aerospace.ubi.pt), FCT research unit #151, supported by Portuguese Foundation of Technology.

He published more than 41 articles in scientific journals (Scopus Author ID: 24759546200). The research field is related to Materials Engineering and Solid Mechanics, namely Biodegradable Polymers, Biocomposites and Biomaterials. His work involves design, mechanical characterization and numerical modelling.