

FIRE RETARDANCY AND MECHANICAL PROPERTIES OF NATURAL FIBER-REINFORCED COMPOSITES

Tsegaye Lemmi¹, Marcin Barburski¹, Agata Poniecka¹ and Rebecca Emmerich²

¹ Lodz University of Technology, Faculty of Material Technologies and Textile Design, Institute of Architecture of Textiles, Lodz, Poland, e-mail: Tsegaye.lemmi@p.lodz.pl; Marcin.barburski@p.lodz.pl; Agata.poniecka@p.lodz.pl

² Institut für Textiltechnik of RWTH Aachen University, Otto-Blumenthal-Straße 1, 52074 Aachen, e-mail:

Rebecca.emmerich@ita.rwth-aachen.de

Abstract: In recent years, the search for sustainable composite materials in the automotive, aviation, and construction industries has increased the interest of researchers in natural fiber-reinforced composites. The availability, cost-effectiveness, renewability, and satisfactory mechanical properties make natural fibers an attractive ecological alternative to inorganic fibers used for the reinforcement of composites. However, despite these benefits, the flammability of NFRCs remains a significant challenge that needs to be addressed. Consequently, various researchers have dedicated efforts to investigating and implementing diverse flame-retardant solutions to enhance the fire resistance of NFRCs, aiming to broaden their applicability and ensure their safety in demanding environments [1-5]. In this study, the approach of using a fiber with inherent fire resistance properties as a composite reinforcement was employed. A fabric made from animal-based natural fiber, wool fiber was used because of its outstanding fire resistance as a composite reinforcement along with the flax fabric. Three varieties of composite samples reinforced with wool fabrics, flax fabrics, and wool-flax fabrics were produced using a resin-infusion technique. Bio-based epoxy resin was used to produce composites. The experimental investigation was carried out on each type of composite sample produced to analyze the mechanical and flammability properties of the NFRC samples. The experimental results obtained from the tensile strength, bending strength, impact, flame retardancy test UL-94, and Limiting Oxygen Index (LOI) were thoroughly analyzed and presented. The results indicated that the use of wool fabric as a reinforcement material has an outstanding effect on the flame retardancy of the composites.

KEYWORDS: WOOL, COMPOSITE, NATURAL FIBERS, SUSTAINABILITY, FLAMMABILITY.

Table 1 Varieties of the composite samples produced

| Sample number | Reinforcement type | Resin type | Composite manufacturing technique |
|---------------|-----------------------------|-----------------|-----------------------------------|
| 1 | Wool fabric | Bio-epoxy resin | Resin infusion |
| 2 | Flax fabric | Bio-epoxy resin | Resin infusion |
| 3 | Wool fabric and Flax fabric | Bio-epoxy resin | Resin infusion |

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