The research of the thermal insulation properties of multi-layer laminates made from recycled materials

Michał Frydrysiak*† , Zbigniew Pawliczak[1], and Mateusz Wolicki[2]

[1]Faculty of Textiles and Design, Technical University of Lodz – Poland
[2]Faculty of Process and Environmental Engineering, Technical University of Lodz – Poland

Abstract

The textile industry is responsible for the generation of billions of tonnes of CO and millions of tonnes of waste on an annual basis. This necessitates the development of novel methodologies for the management of these materials in accordance with the principles of the circular economy. The present thesis is concerned with the development and testing of a thermal insulation laminate. This laminate possesses a multi-layered structure, with a core composed of recycled cotton and flax fibres at its centre. The production process for the laminates was primarily based on advanced mechanical recycling of textile scraps. However, this process varies depending on the raw materials utilised and differs in the number of operations involved. The aim of the research was to assess the thermal insulation properties of the manufactured laminate and to compare them with traditional commercial solutions. Measurements were carried out using the two-plate method with a Poensgen apparatus. The materials were also subjected to thermal resistance testing under conditions of heat radiation. A total of 14 material variants, each 4 mm thick, were analysed. The best variant of the developed laminate achieved an equivalent thermal conductivity of 0.023 W/(m·K). This means that this laminate provides insulation on a par with commercial solutions, comparable to the properties of commonly used insulating foams and mats. Therefore, the research conducted has unequivocally demonstrated that a laminate based on recycled textile materials can be an effective alternative to traditional thermal insulation materials.

Keywords: Recycling, Textiles, Laminates, Thermal Insulation, Measurements

*Speaker
†Corresponding author: michal.frydrysiak@p.lodz.pl