

# Fracture properties analysis of plastic materials using as skin layers in rotationally moulded skin-foam-skin sandwich structures

Abu Saifullah<sup>1\*</sup>, Forkan Sarker<sup>2</sup>, Prof. Ayub Nabi Khan<sup>3</sup>

<sup>1\*</sup>*Bournemouth University, Talbot Campus, Bournemouth, UK.*

<sup>2</sup>*University of Manchester, Oxford Road, M13 9PL, Manchester, UK.*

<sup>3</sup>*BGMEA University of Fashion & Technology (BUFT), Bangladesh*

*Corresponding Author E-mail: [asaifullah@bournemouth.ac.uk](mailto:asaifullah@bournemouth.ac.uk)*

## *Abstract*

Rotational moulding is a low pressure, high temperature manufacturing method and is considered to be the best for making large hollow shape plastic parts. Due to its long heating cycle, mould rotation during heating and slow cooling rate, it is completely different from injection or other moulding processes. In the rotational moulding process, multilayer plastic product such as skin-foam-skin three layered sandwich structure can be manufactured in a single or multiple manufacturing step without any joints. It exhibits relatively high stiffness, strength-to-weight ratios and is used increasingly in various applications such as automotive and marine leisure craft. During the lifetime of the sandwich material, it gets scratch, cracks and subsequent rapid fracture propagation particularly in skin layers. Therefore, a better understanding of fracture properties of plastic materials using in skin layers of rotationally moulded sandwich structures is essential to confirm the durability, reliability and safety of these sandwich structures in various load bearing applications. In this work, two types of commercially available rotationally moulded polyethylene (PE) and polypropylene (PP) plastics were investigated which can be used as skin layers to manufacture sandwich structure. Fracture properties were tested under the theory of elastic-plastic fracture mechanics and drop weight impact condition. Fracture initiation points were identified for all of the plastic materials. PE showed better fracture properties compared to PP in terms of fracture initiation and propagation resistance. Microstructural details were also investigated and it was concluded that fracture behaviour of these plastics is closely related to their crystal structure, amorphous thickness and loss modulus.

**Keywords:** Rotational moulding, plastic, fracture, sandwich, microstructure.

Full paper is not available. The speaker can be contacted for further details