

Current advances in fabric-based airbag material selection, design and challenges for adoption in futuristic automobile applications

M. S. Parvez^{a,b}, M. M. Rahman^{a,c}, M. Samykano^a, Mohammad Yeakub Ali^d

^aAutomotive Engineering Research Group, Faculty of Mechanical and Automotive Engineering Technology, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

^bDepartment of Textile Engineering, Khulna University of Engineering & Technology (KUET), Khulna 9203, Bangladesh

^cCentre for Research in Advanced Fluid and Processes (CARIFF), Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300, Gambang, Kuantan, Pahang, Malaysia

^dMechanical Engineering Programme Area, Faculty of Engineering, Universiti Teknologi Brunei, Tungku Highway, Gadong BE 1410, Brunei Darussalam

ABSTRACT

Airbags in vehicles play a pivotal role in ensuring occupants' safety for a long time. With the advent of the latest technology, the airbag has elevated from a mere piece of clothing to a functional interface. A variety of airbags are being introduced in multiple vital positions of a vehicle to mitigate injuries in car accidents. Apart from saving lives, the global airbag market is also expanding at a staggering speed, and the estimated value is worth USD 48.10 Billion by 2030 at a CAGR of 7% from the years 2022 to 2030. Additionally, Airbag fabric is evolving lighter from coated to uncoated fabric to fit with the emergence of lightweight materials. And more preferences are given to the materials to be more durable for years and functionality. Despite the rapid progress in this field, integrating innovative materials is currently limited to practical applications. Moreover, many of the advancements in newly formed airbags are limited to lab-scale production only. This paper signifies the choice of airbag manufacturing materials, types of airbags used in automobiles, upcoming innovations, challenges with airbag placement, and integration in futuristic vehicles. It is speculated that this mini-review will help understand the current challenges and offer more profound insight into the future of advanced airbag design.

KEYWORDS

Airbags; Textiles; Nylon 6; Lightweight material; Automotive

ACKNOWLEDGMENTS

The authors would like to thank Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), Pekan, Malaysia, for providing the laboratory facilities and financial support under the International Publication Research Grant No. RDU223301 and Postgraduate Research Grant Scheme, UMPSA, Malaysia (PGRS210370).