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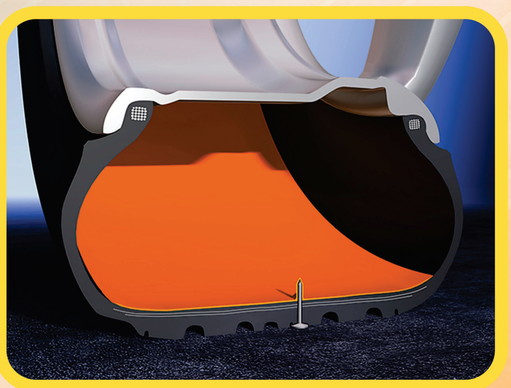
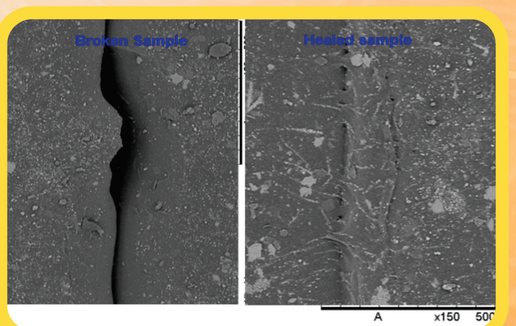
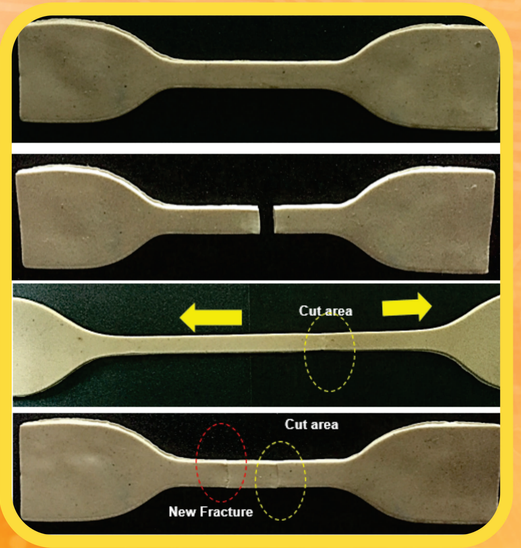
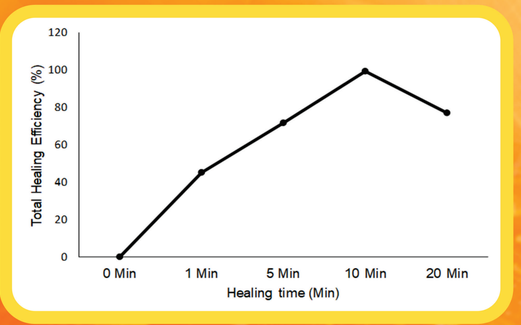
TRADE SECRET (TS/IO/2019/046)

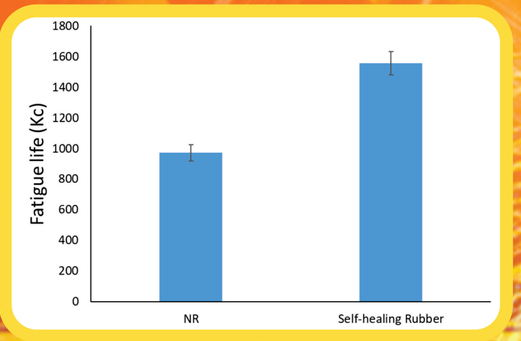
SELF-HEALING MAGNETORHEOLOGICAL ELASTOMER FOR SMART AUTOMOBILE TYRES











Problem Statement

- Statistics from the National Highway Traffic Safety Administration, US estimate that tire blowouts cause over 78,000 accidents every year. This results in approximately 10,000 injuries and 400 deaths.
- In Malaysia approximately 20% of road accident root cause is due to tyre blowout
- Tyre blowouts can occur in a variety of situations. Debris such as broken glass and nails can compromise the integrity of a tyre, increasing the chances that it will blow out while on the road.
- Rubber is the main material for tyre manufacturing. Indeed the properties of rubber can sustain large deflections with little or no permanent deformation, rubbers still fail through fracture, puncture and fatigue.

Novelty and Inventiveness

Self-healing Magnetorheological Elastomer (MRE) for Smart Automobile Tyres engineered in this invention has the capability to repair itself and to recover functionality when it is damaged without the need for detection or repair by manual intervention of any kind.

The material was developed based on natural rubber and industrial waste nickel zinc ferrite particles and vulcanized using self-developed self-healing curative agent.

Applicability

Self-healing MRE forms a sealing layer, which is placed inside the tyre in the area corresponding to the tread pattern.

In case of penetration by external objects such as nails, there is no need for immediate roadside tyre changes, the material deals immediately with the hole and, in most cases, its fast and effective action means that the driver would not even realize that the tyre has been punctured

The material immediately repair itself, recover the tyre functionality and blocks every possible air leakage in the event of a puncture that passes through the tyre, with or without an external object still present.

Self-healing MRE can be used to manufacture new tyre or adhered into inner layer in existing tyre and does not need special rims or Tyre Pressure Monitoring System; it can be used on any kind of vehicle tyres and tyre sizes.

Product/Technology Readiness

TRL 4
Research had been validated in lab scale

Proof of concept

- Self-healing MRE as inner layer for automobile tyre- Malaysian Rubber Board (MRB)
- Self-healing MRE as seal layer in existing tyre – USM Rubber lab

Research Achievement

Publication published in 8 ISI Journals

Research Funds

FRGS (RM138,180.00)
Raa Khimi Bin Shuib, The mechanism of damping in magnetorheological elastomers, 01/08/2016-31/01/2020

USM Short Term (RM33,348.40)
Raa Khimi Bin Shuib, Fabrication and Characterization of Magnetorheological Elastomers for Vibration Damping 15/06/2016-14/06/2018

Talent Development

Graduated 2 MSc and 4 B.Eng students

Intellectual Property

- Copyright granted by MyIPO (LY2019004343)
- USM Trade Secret (Formulation of self-healing crosslinker) - TS/IO/2019/046

Commercialization Potential

- Self-healing MRE material cost is 20-28% lower compared with conventional rubber products. (MRE= RM 5.07/KG vs Conventional Products = RM 6.50-RM 7.10/KG)
- This material has huge potential to be applied to all automotive rubber parts such as hose, seals, gasket, interior panel and etc.
- Industrial collaborators- Malaysia Rubber Board (MRB), JEBCO, PETROGROUP and ACME

Level of Impact

ECONOMIC	SOCIAL	ENVIRONMENT
Extended lifetime Reduction of maintenance costs	Increased reliability Enhanced safety Fewer accidents Prevent catastrophic failures	Energy saving Cuts in pollutants-less rubber waste

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