

**ENHANCING THE CUSHIONING EFFECT OF SOLID  
TIRE CUSHION COMPOUNDS BY INTRODUCING  
THERMALLY EXPANDABLE MICROSPHERES**

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## DECLARATION

I declare that this is my own work, and this thesis does not include without confirmation any material previously submitted for obtaining a degree or diploma at any other university or higher educational institution, and as far as I know and am convinced that it does not contain any material previously published or written by another person, unless it is done in the text.

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The above candidate has carried out research for the master's thesis dissertation under my supervision.

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## ABSTRACT

Solid tire industry is a rapidly growing industry all over the world with a very high demand for different kinds of material handling equipment manufacturing companies. In this case, resilient tires are playing a major role. Resilient tires are widely used in different kinds of applications especially in material handling equipment like forklifts. Mostly this equipment will be used in different environmental conditions like severe sun light, heavy rain, extreme wind, etc. In addition to that, this equipment will be running on different kind of ground conditions like metal yards, concrete pavements, and severely damaged floor conditions etc. When it comes to the tire manufacturer, it is their responsibility to produce tires as per the customer requirement in order to satisfy the basic needs of the customer. In this case, “Resilient tires with good comfort” is one of the key requirements which is coming from the tire users. Base, Cushion & Tread are the three main components of a resilient tire. Base component is the part which is mounted to the vehicle whilst the Tread part will be in contact with the ground surface during motion. Cushion part will act like a bridge between base and tread by delivering perfect comfort to the machine operator. When it comes to the material handling vehicles like forklifts, they are heavy duty machines and operator comfort is very important during running conditions. In order to facilitate a perfect comfort, function of the cushion part plays the major role which can be described technically as “*Cushioning Effect*”. Even though it is important that the factor cushioning effect of a resilient tire, there are some limitations and challenges to overcome for tire manufacturers to optimize the cushioning effect whilst maintaining other tire properties at the desired levels. Main challenge is to keep the cushioning property at its optimum level and maintain the other physical properties like tensile, hardness, modulus, elongation, tearing, etc. In general, cushioning effect is gained by using a blend of semi-reinforcing carbon black with different particle sizes. Since the use of this blend has many limitations, a serious requirement is there to find a better solution to enhance the cushioning effect of resilient tires whilst maintaining other required properties at the specified levels. This study is an effort of enhancing the cushioning effort of resilient tires by incorporating *Thermally Expandable Microspheres (ThEM)* into the cushion compound. New compounds were produced by introducing variable ThEM quantities and compared with the regular cushion compound. A series of compound and tire tests were performed in order to identify the perfect formulation with better performance.

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