

**AN INVESTIGATION OF THE INFLUENCE OF MECHANICAL  
TREATMENT ON THE RUBBER TO METAL BONDING  
STRENGTH IN INDUSTRIAL TIRES**

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## DECLARATION

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Date: 25/05/2024 \_\_\_\_\_

Prof. M.A.R.V. Fernando

Signature: \_\_\_\_\_

Date: 25/05/2024 \_\_\_\_\_

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## ABSTRACT

In industrial tire applications, single-piece replacement (Press-on and Cured-On) tires contain integrated steel rims and tires. These are manufactured by bonding layers of rubber to steel rims. These are manufactured as replacement parts for the heavy machinery industry. Therefore, establishing a reliable bond between the rubber tire and the metal rim is critical to the quality of the product. The bonding surface of the steel wheel undergoes a grit blasting process to prepare the surface for rubber bonding. After this process, primer and adhesive are applied before rolling the rubber on the steel surface. The purpose of abrasive blasting or grit blasting is to clean the bonding surface and maintain the surface roughness up to a certain level. A strong adhesive bonding between the substrate can be established by enhancing the roughness of the substrate material. However, a high rate of product defects is observed due to failures in the rubber-to-metal bonding. Studies conducted by R&D teams have recognized that inconsistencies in surface roughness influence the bond between the two layers.

This research was aimed to investigate the impact of surface roughness of the bonding surface on the bonding strength. The objectives were to determine the factors that influence the surface roughness of the bonding surface, to investigate the influence of these factors on the bonding strength, and to establish feasible methods for mechanical anchoring.

In this pursuit, a literature review was conducted to determine the factors that influence surface roughness. Then, a designed experiment was carried out to investigate the influence of the identified factors on the surface roughness of the bonding surface. Finally, surface preparation methods were established to have a strong consistent bond between the rubber and the metal rim. Throughout the laboratory experiments, the best mechanical anchoring solutions and their significant impact on the bonding strength were recognised. Moreover, the study was instrumental in clearly identifying the areas to further develop.

The results can be used to prepare surfaces to enable effective bonding in mass-scale structural steel applications. There are areas to be developed such as contour/profile optimisation and degradation effects (for example, wear, weather conditions, physical and chemical reactions, etc.) in the future.

**Keywords:** Rubber to metal bonding, Mechanical anchoring, Surface roughness, Process parameters.

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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
ACM	Association for Computing Machinery
IEEE	Institute of Electrical and Electronic Engineers
OPAC	Online Public Access Catalogue
ASTM	American Society for Testing and Materials

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