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Watching Bond Breaking during Tire Wear by Friction

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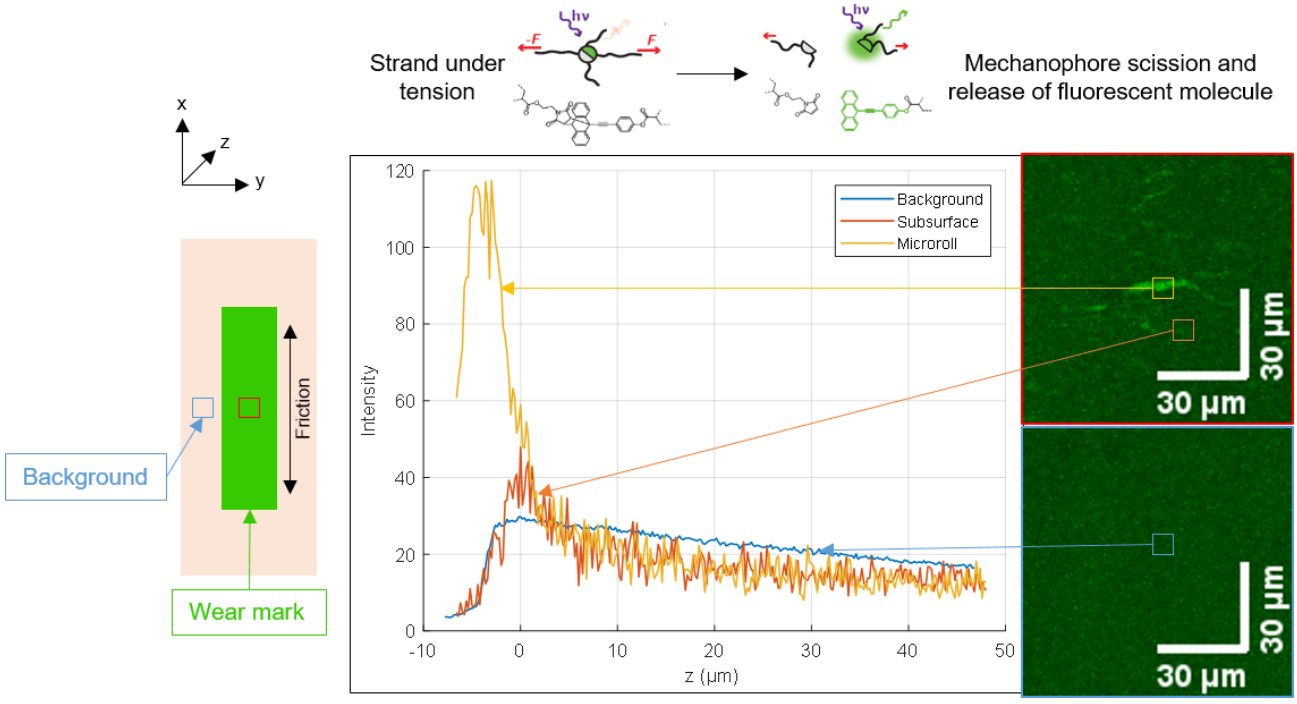
Tire wear results from the sliding contact between the rubbery tire tread and the asperities of the road surface. This process leads to material abrasion, altering tire performance and generating wear particles. Thus, tire wear is a critical challenge for the transportation and automotive industry, associated with major safety, economic, and environmental issues.

In the literature, the macroscopic characterization of tire wear is well-documented with wear ridges observations[1], friction coefficients analyses, and mass loss quantifications[2]. However, the microscopic understanding of tire wear is still incomplete and some questions remain: What happens beneath the surface? How many polymer chains break during wear? What are the molecular-scale mechanisms of bond rupture?

Here, we present a state-of-the-art mechanochemical strategy that has been developed to combine macroscopic wear measurements with molecular damage quantification[3]. This strategy relies on the incorporation of a mechanophore molecule in a filled rubber[4], which becomes fluorescent when a specific bond breaks, allowing for the robust, reliable and direct spatial quantification of the otherwise undetectable chain damage in the material.

The mechanochemical approach will help to reveal a new molecular picture of elastomer frictional wear and allow to achieve a comprehensive understanding of bond breaking during tire wear by friction.



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