Nikolas Ojala 2025-02-14

Super-Elastic Nitinol Pin for Winter Tire Stud

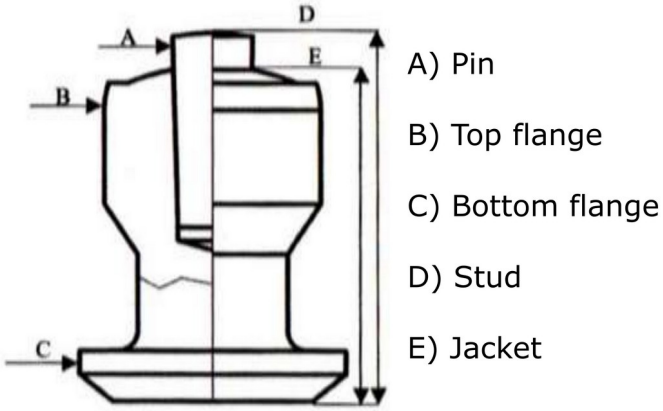
Abstract: This article proposes the use of super-elastic Nitinol as a potential material for manufacturing studs in winter tires, aiming to reduce road surface wear while maintaining stud longevity and performance.

The pins of tire studs are traditionally made from hard materials like tungsten carbide to provide traction on icy and snowy roads. However, these materials can significantly wear down road surfaces. Super-elastic Nitinol, with its unique elasticity and self-healing properties, could offer a novel solution.

Nitinol's Key Properties:

- Abrasion Resistance: Nitinol is notably resistant to abrasion, potentially leading to less wear on both the studs and the road.
- Self-Healing: The material's ability to return to its original shape after deformation can help maintain stud effectiveness over time.
- Moderate hardness: Unlike tungsten carbide, Nitinol is not very hard.

Proposed Structure of a Stud:



Structure of a tire stud

Advantages:

- Reduced Road Wear: The elastic nature of Nitinol could lead to less road surface damage.
- Longevity: Studs might maintain their shape and effectiveness longer due to Nitinol's self-healing properties.
- Environmental Impact: Nitinol is gentle to the road and non-toxic.

Challenges:

- Performance Testing: Real-world testing is necessary to confirm Nitinol's durability and performance in practical winter conditions.
- Manufacturing: The unique properties of Nitinol might require new manufacturing techniques for studs.

While super-elastic Nitinol presents a novel approach to winter tire stud design, extensive testing and development are needed to validate its application. This article serves to document the concept of a tire stud with a Nitinol pin.