Institut für Maschinenkonstruktion und Tribologie
Leibniz Universität Hannover
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Eco-Friendly Grease: Oleogelator-Based Formulation with Carbonaceous Waste Nano-additive

Belal Nassef, Florian Pape, Gerhard Poll, Max Marian, Mohamed G. Nassef, Hassan S. Hassan, Marwa Elkady

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Emerging Trends in Green Tribology

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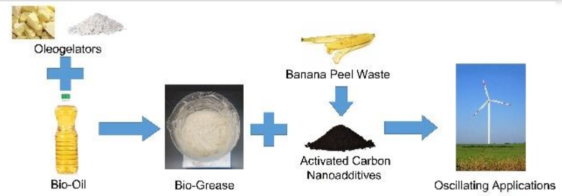

Bio-Grease Combined with AC for Industrial Application

Research Overview

Source Material:

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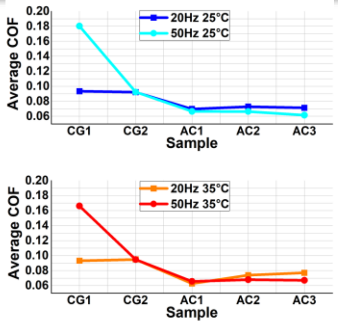

Frictional trends of bio-grease samples

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Anti-friction mechanism:

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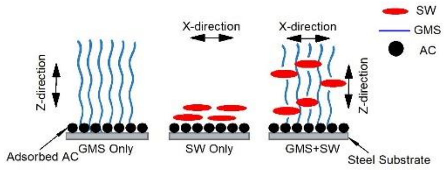

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Key Findings:

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Future research is going to take into concern the application in oscillating bearings.

Integrated Evaluation for Industrial Adoption:
To ensure successful implementation of bio-grease in industrial settings, both its production efficiency and in-service performance must be critically assessed, with a strong focus on maintaining cost-effectiveness.

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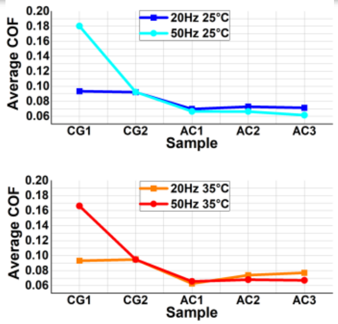

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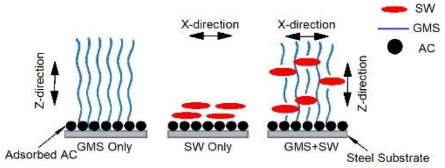

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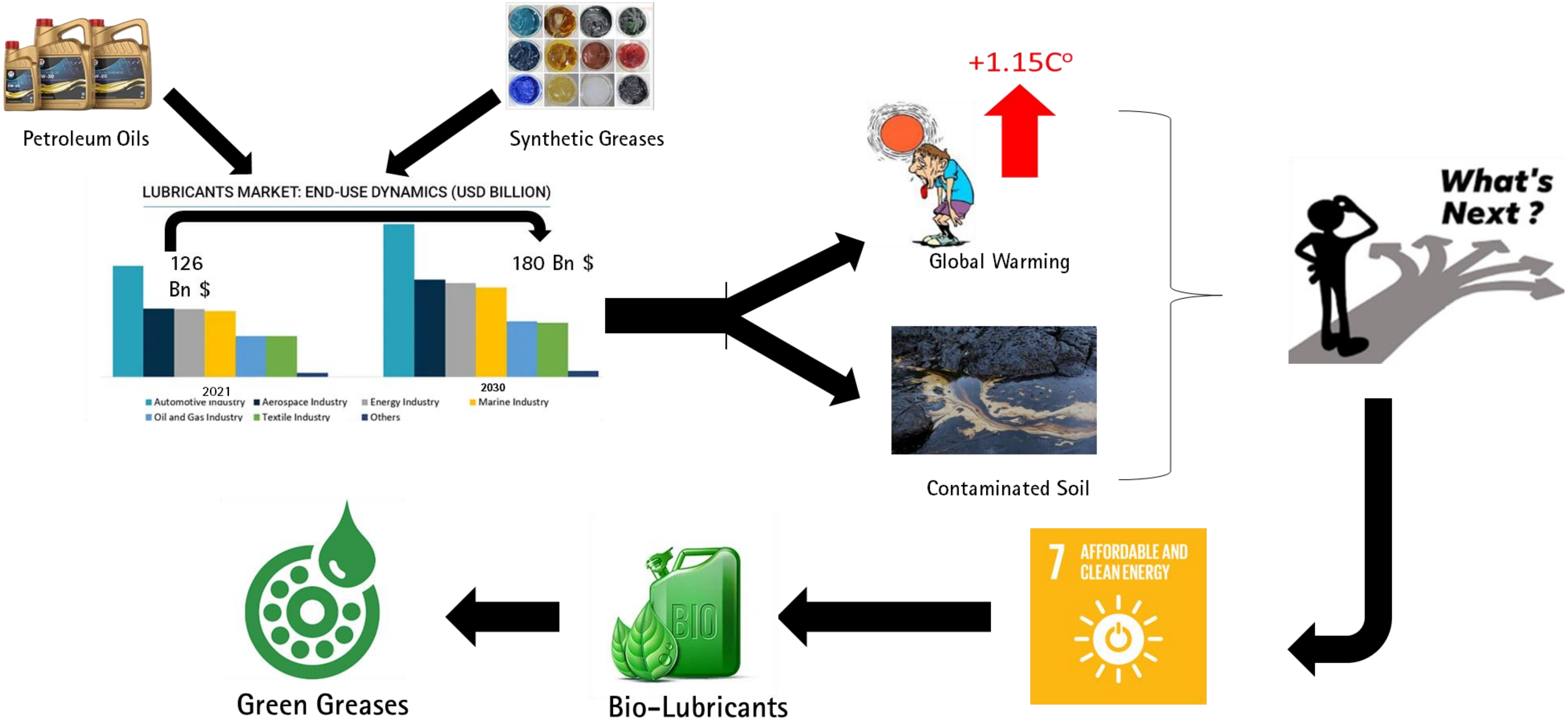
Why Bio-grease ?



Motivation

Objective

The primary aim of this work is to develop a bio-grease formulated from natural sources, including bio-oil and bio-based thickeners (waxes), and to enhance it with sustainable nanoadditive derived from waste, thereby improving its ability to withstand higher oscillating friction frequencies.

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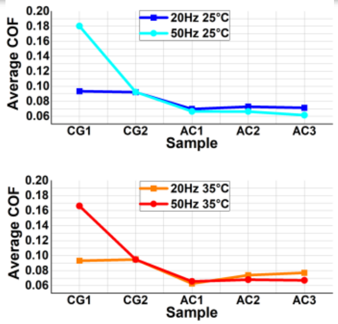

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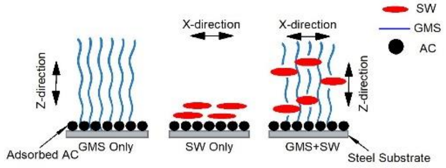

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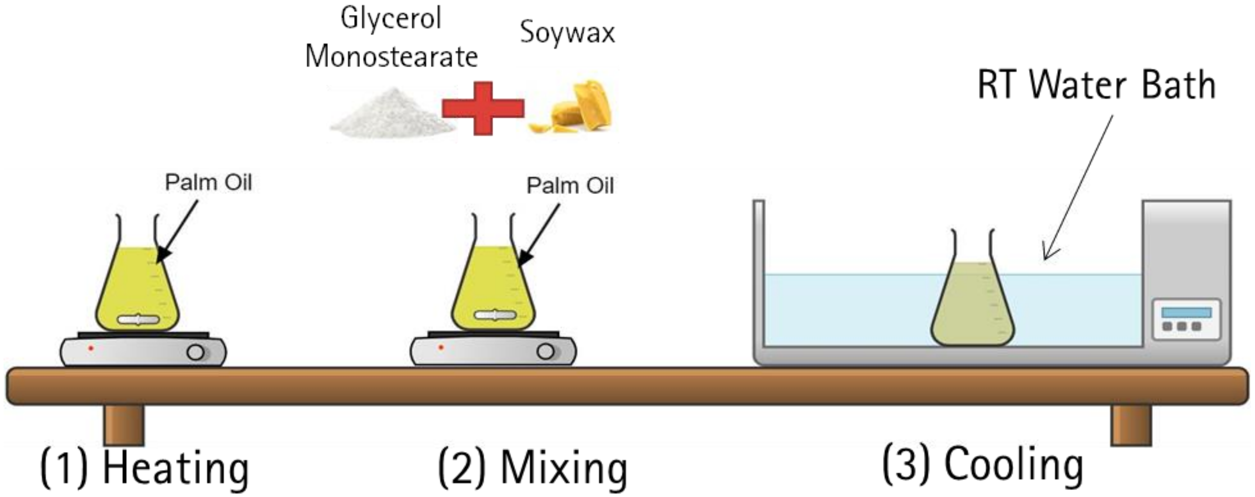
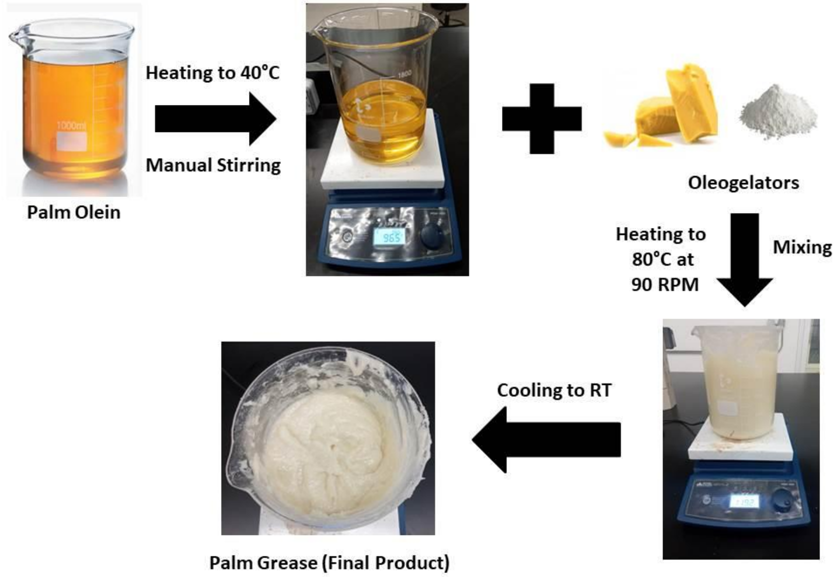
Research Overview

Grease Preparation

- Dispense appropriate oil quantities into the container.
- Heat the oil to 40℃ while stirring to achieve even temperature distribution and homogenization.
- After 10 minutes of stirring, gradually introduce the oleogelator according to specified percentages.
- Increase stirring speed and temperature to 90 rpm and 100℃, respectively.
- Continue stirring for 60 minutes to ensure thorough dispersion and homogenization of the mixture.
- Allow the mixture to cool down to room temperature (25℃).
- Sample containing 10% Glycerol monostearate with 10% Soywax is selected based on its Rheological behaviour.





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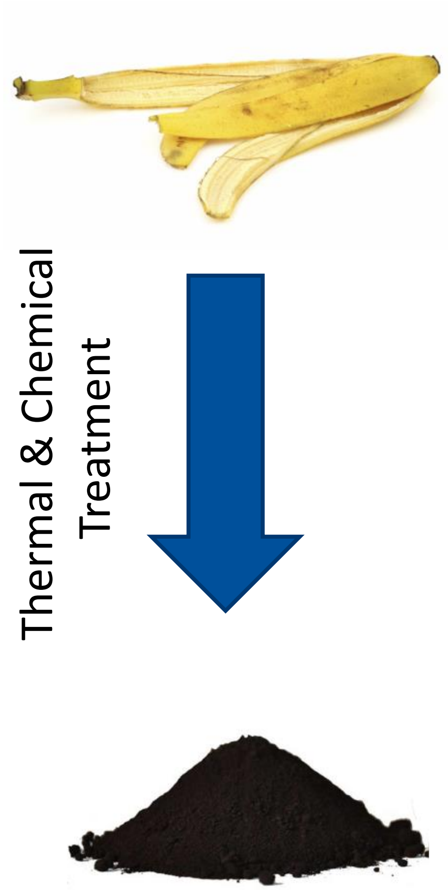
Research Overview

Activated Carbon (AC) Nano-additive

- AC preparation method involves:
  - Raw Material Collection & Pretreatment
    - Banana peels were collected, washed with distilled water, and dried for 3 days.
    - The dried peels were ground into fine powder using a multifunctional electric grinder.
  - Chemical Treatment
    - Alkaline-treated powder placed in autoclave, followed by heating to 700℃ for minutes.
    - Allowed to cool overnight.
  - Particle Size Reduction
    - Resulting AC was ball-milled for a couple of days.
- 3 percentages of AC was was added to bio-grease (1, 2 and 4wt.%) (AC1, AC2, and AC3)
- The mixtures are compared with Li grease (CG1) and Ca Grease (CG2)



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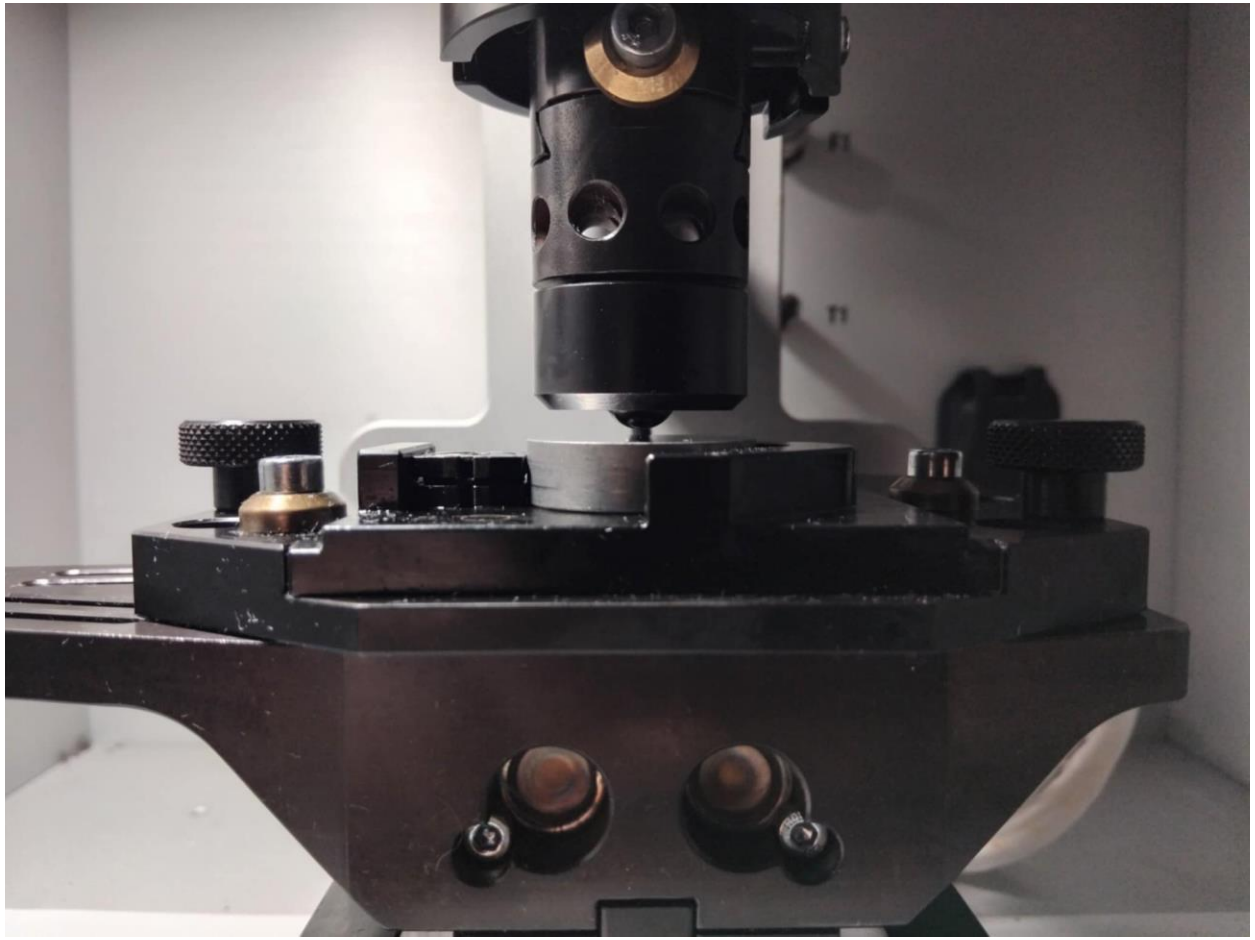

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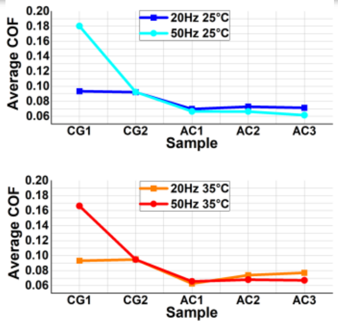

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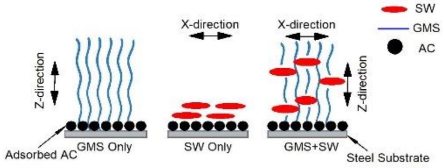

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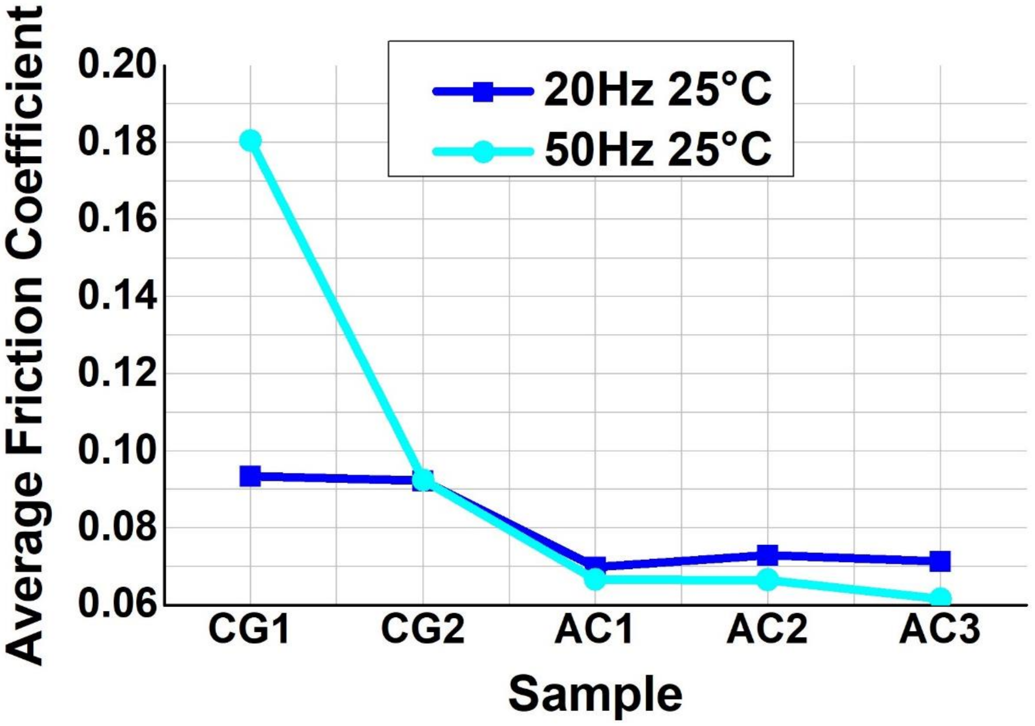
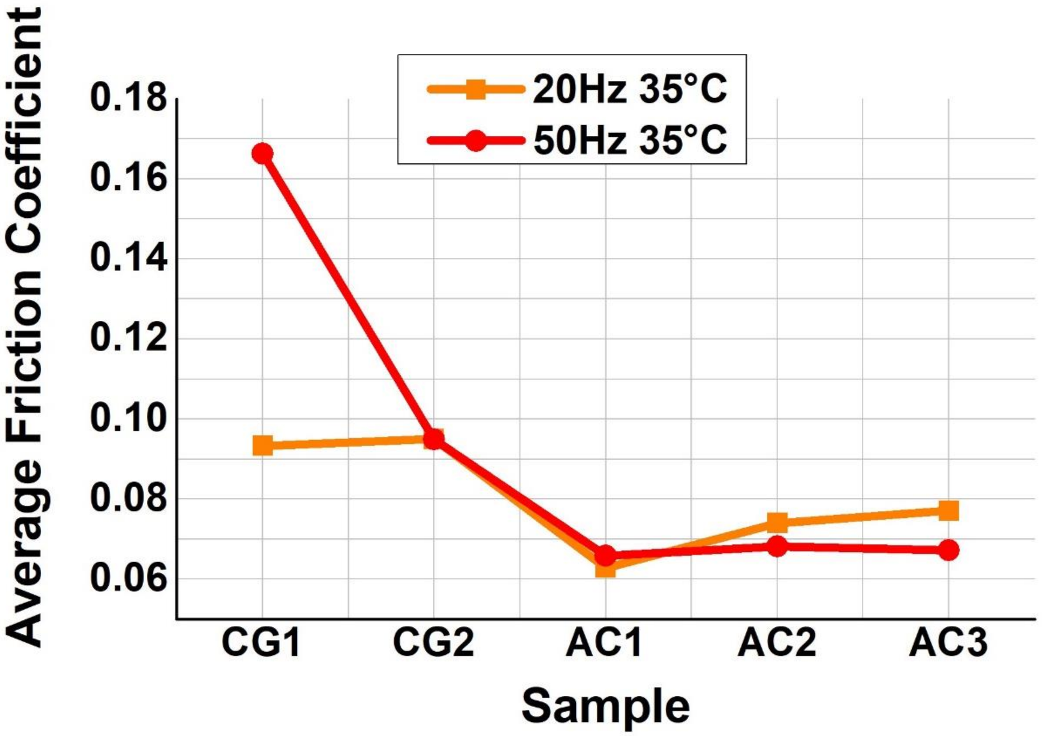
ETS Tribotester Results

COF at Different Frequencies and Temperatures





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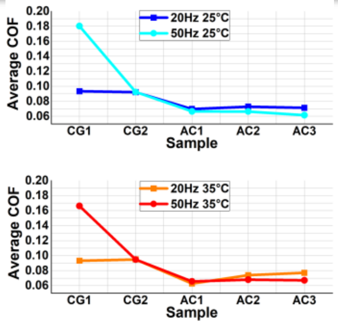

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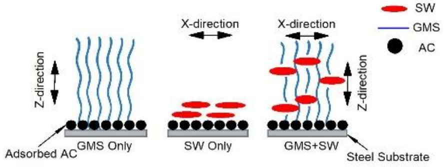

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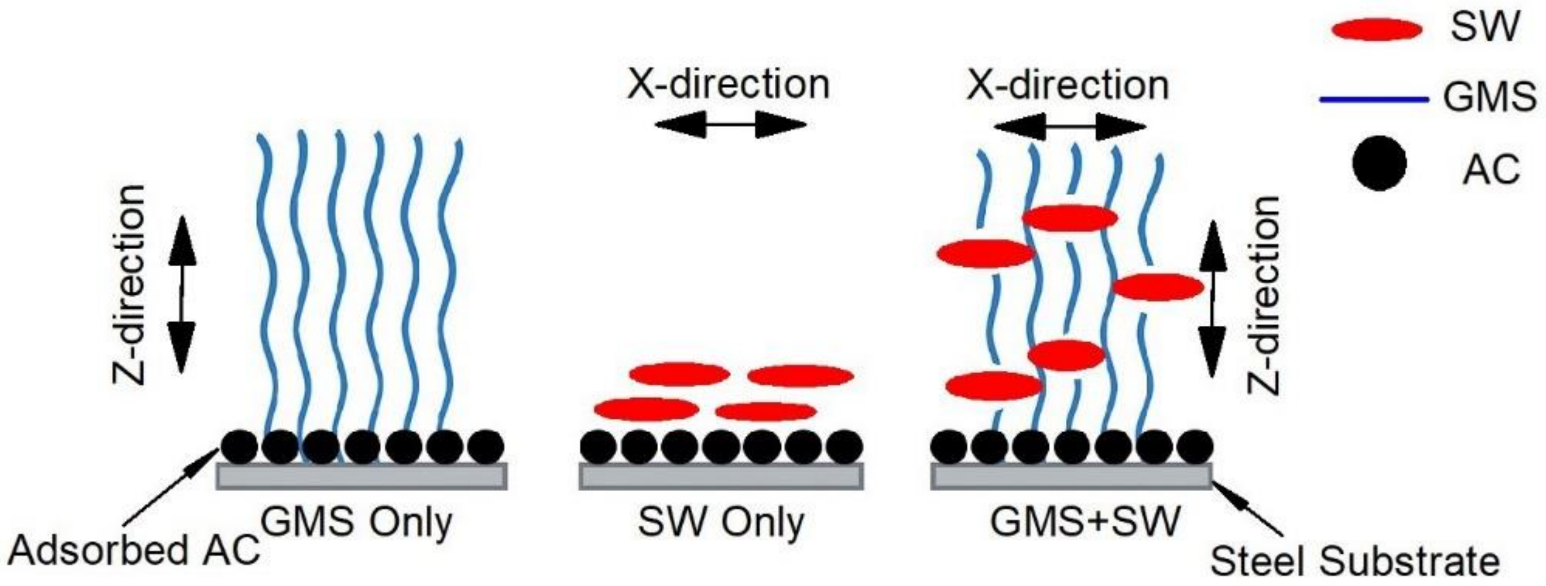

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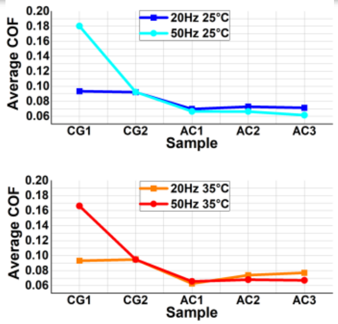

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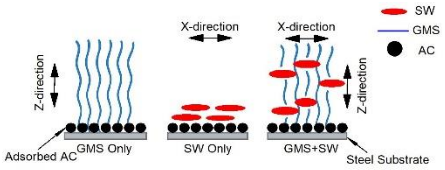

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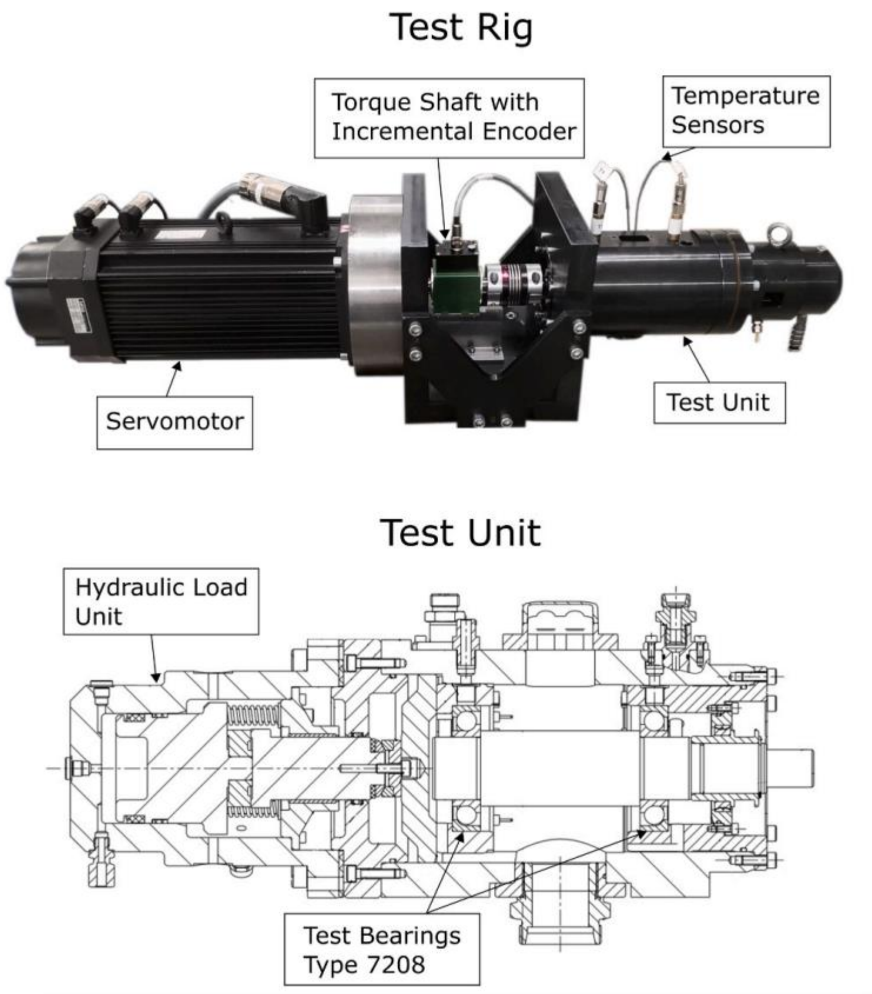
Conclusion

Future Work



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We sincerely thank Optimol Instruments for kindly providing the equipment used in this work.

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