NANOENGINEERING CELLULSOE FOR REPLACING PETROLEUM BASED LUBRICANTS

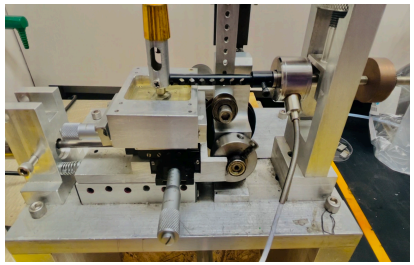
PennState College of Engineering

Shambhavi Datta Chowdhury , Dr. Amir Sheikhi

BACKGROUND

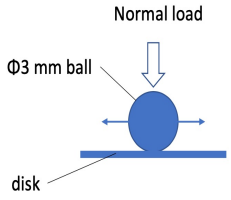
Φ3mm **glass** ball vs **glass** slide (cleaned with UV/O3)
Normal load = 0.2 N

The overarching goal of this project is to replace petroleum-based lubricants with hairy nanocellulose. Tested different concentration of cellulose (CNC,CNCC,ENCC) on glass ball vs glass slide to find out the lowest coefficient of friction. Using a tribometer we study the surface chemistry of various materials by applying a load of 20 kg.

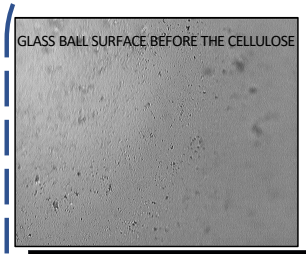


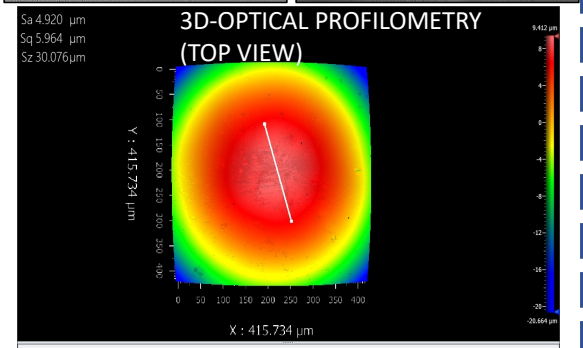
EXPERIMENT IN PROGRESS

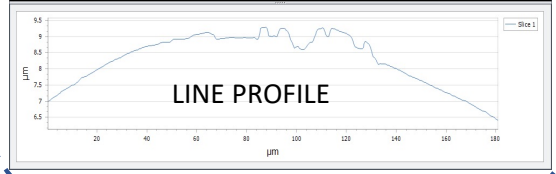
FUTURE PLANS: TO TEST OUT DIFFERENT MATERIALS SUCH AS SAPPHIRE & STAINLESS STEEL



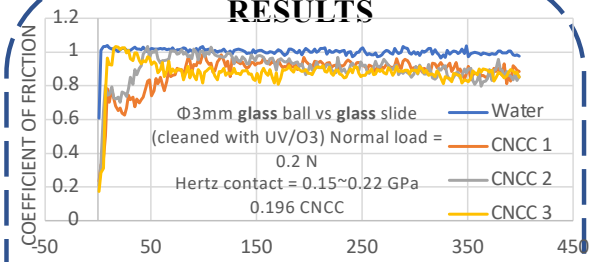
GLASS BALL SURFACE

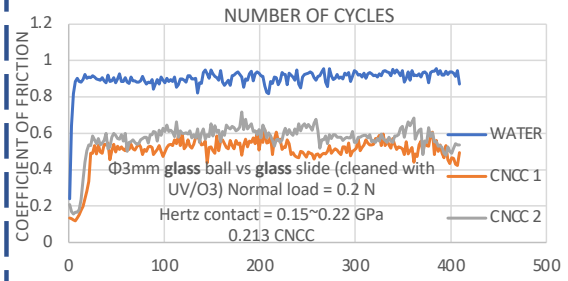


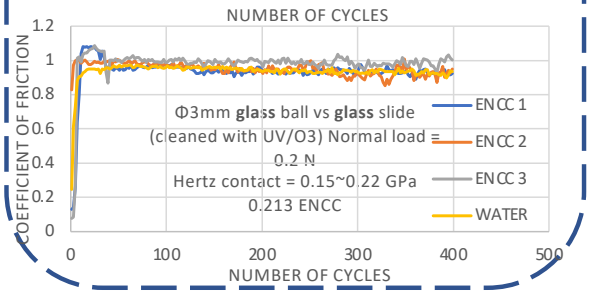




RESULTS







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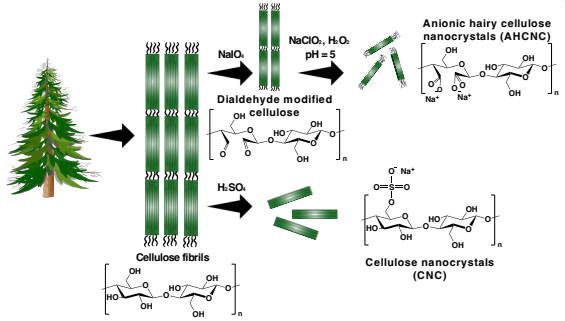
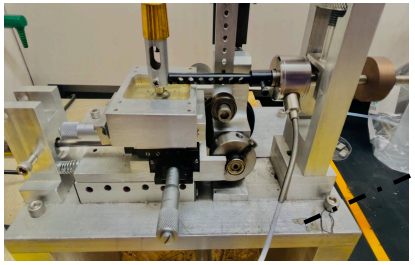


Reference: Highly functional bio-based micro- and nano-structured materials for neodymium recovery. (2022). Chemical Engineering Journal. https://www.sciencedirect.com/science/article/pii/S1385894722029060?casa_token=NC1hGz804s4AAAAA:FO0l03NY3OrYnl9in7eee2RYoawoOllOuUSmH_nORfhSwIfibnle6v5KLmrRHUK1B5TeiVlmvrM



TRIBOMETER

DATA ANALYSIS

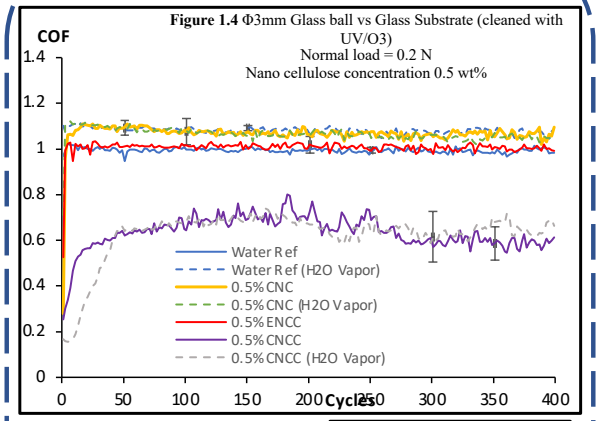
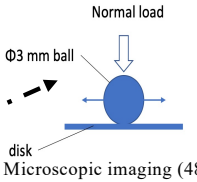
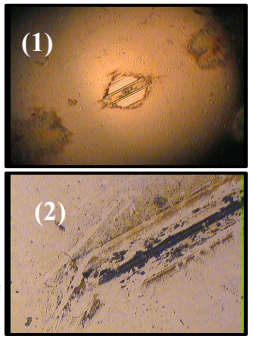


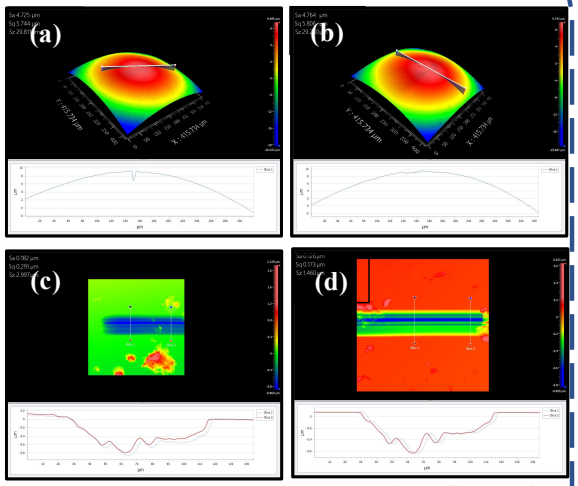
Figure 1.4 Φ3mm Glass ball vs Glass Substrate (cleaned with UV/O3)
Normal load = 0.2 N
Nano cellulose concentration 0.5 wt%



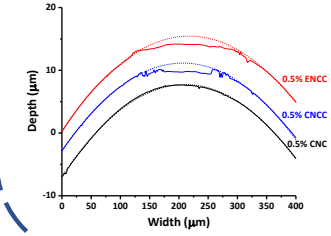


Microscopic imaging (480 µm x 582 µm) of (1) worn ball surface after 250 runs of tribological testing in distilled water under 20 g load; (2) left-end wear track of worn substrate after 250 runs of tribological in distilled water under 20 g load

RESULTS



CNCC IS A PROMISING CANDITATE TO REPLACE PETROLEUM BASED LUBRICANTS



3D-Optical Profilometry of (a) Φ3mm glass ball before tribological testing; (b) Φ3mm glass ball after tribological testing with 5 drops 0.5% CNCC under 20 g load (c) left-end wear track of tribo-tested glass substrate with perpendicular-to-wear-track line profiling; (d) middle-section wear track of worn glass substrate with perpendicular line profiling