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# Simultaneous Imaging and Friction Measurement with In-situ Tribometer


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## STAGE OF DEVELOPMENT
Prototype device

## INTELLECTUAL PROPERTY
Patent application filed

## DESIRED PARTNERSHIPS
- License
- Sponsored research

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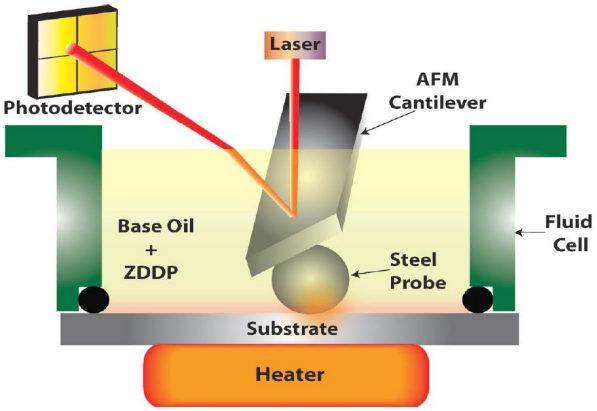
## Problem
Different instruments are needed to study the interaction of contact surfaces at different length scales. Tribometers measure the coefficient of friction, but they cannot image the micro- or nano-scale contact area. Atomic Force Microscope (AFM) techniques can image surfaces at smaller scales, but they do not enable tests to be performed with probe materials (e.g., steel) and properties (e.g., roughness) needed to represent many important, realistic tribological applications.. Removing a sample to change instruments can expose the region of interest to environmental contaminants and can lead to changes in the physical and chemical properties of the sliding zone.




## Solution
The new device combines a tribometer's ability to measure friction phenomena with relevant materials and surface topographies with an AFM probe's ability to directly image the topology of surfaces with nanometer resolution. In this way the macro and nano scale interactions can be studied simultaneously, with the same device, without the need to change instruments or expose the sample to the environment. Other devices that seek to provide the same capabilities use laser inferometry which does not provide accurate three-dimensional topographic information and also does not work well with optically transparent materials. The new device, however, directly images the contact region using an AFM technique, providing resolution on the order of 10 nm. This permits, for example, the rapid formation and characterization of tribofilms under realistic surface roughness and material conditions

## Advantages
- More accurate characterization by taking measurements in situ rather than changing instruments.
- Operation at temperatures up to 250C and pressures up to 1 GPa provides durability for real-world applications
- any probe and substrate material, such as steel-on-steel, can be used. This enables the study of a wide variety of technologically-relevant material pairs
- Provides new insight for the study of lubricated tribological components, performance characterization of a wide variety of lubricants and additives, and the analysis of other mechanical components and types of lubricants where understanding the in-situ interactions is essential