

# Filtration Efficiency of Smart Paper

Laboratory Names: Stoeber Lab & Aerosol Lab

Faculty Supervisors: Profs. Boris Stoeber and Steve Rogak

## General Area of Research

Fluid mechanics, sustainability

## The Project

The piezoelectric paper in Fig. 1a has recently been developed for sensing applications, in particular to measure the amount of particulate matter (PM) in the air. For PM sensing, an air sample is drawn through the paper sample as shown in Fig. 1b, where the paper acts as a filter leading to PM deposition. The added mass of the PM affects the mechanical response of the paper sample. For instance, the resonant frequency of the piezoelectric paper sample (in drum mode) drops as the deposited PM mass increases. The rate of frequency shift is therefore a measure of the PM concentration in air.

In this project, we will quantify the filtration efficiency of these paper samples and their ability to collect PM of different sizes through filtration. This will be achieved by measuring the PM concentration for different particle sizes of a sample suspension before and after it passes through the paper. This includes the construction of a test fixture for the paper sample including a pump to draw the air sample through the paper while measuring the flow rate. The student on this project will learn how to generate and characterize particle suspensions. Part of the project would be selecting the most suitable aerosol source and characterization equipment. Air flow per unit area of filter is part of the design space. In the assessment of the results, the student will estimate the expected collection efficiency for different types of pollution (ie, vehicle exhaust, road dust, forest fire smoke) based on published size distributions.

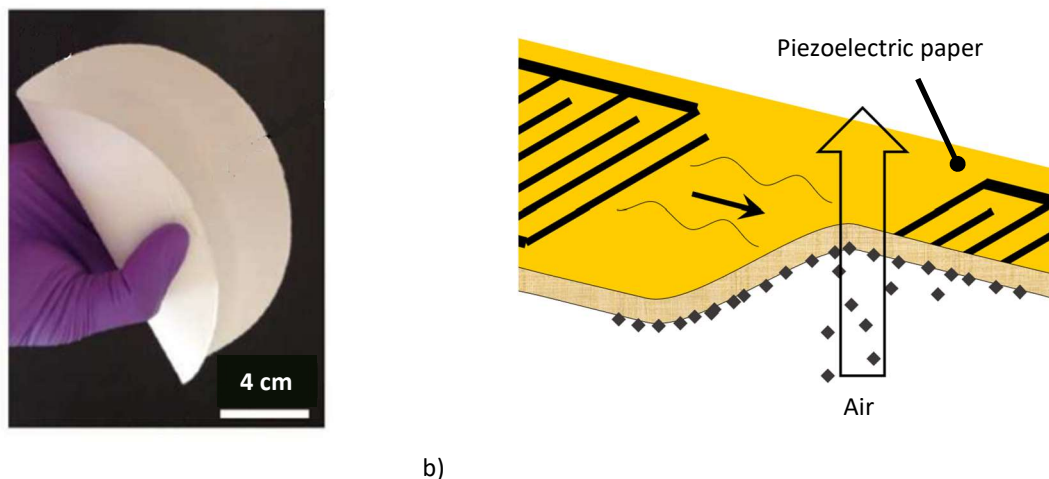


Figure 1: a) a piezoelectric paper handsheet; b) as air is drawn through the paper, PM deposits and affects the mechanical response of the paper PM sensor.

## Facilities and team

Prof. Stoeber's team has developed and produced piezoelectric paper samples. Dr. Rogak's Aerosol lab is well equipped with PM generation and characterization equipment. Contact: [boris.stoeber@ubc.ca](mailto:boris.stoeber@ubc.ca) & [rogak@mech.ubc.ca](mailto:rogak@mech.ubc.ca)