Chemical Characteristics of indoor aerosol particles and surface films

Rachel O'Brien

Amy Hrdina, Emily Legaard, Churchill Wilkinson, Kathryn Mayer, Sumit Sankhyan, Dustin Poppendieck, Delphine Farmer, Marina Vance

UNIVERSITY OF MICHIGAN

reobrien@umich.edu

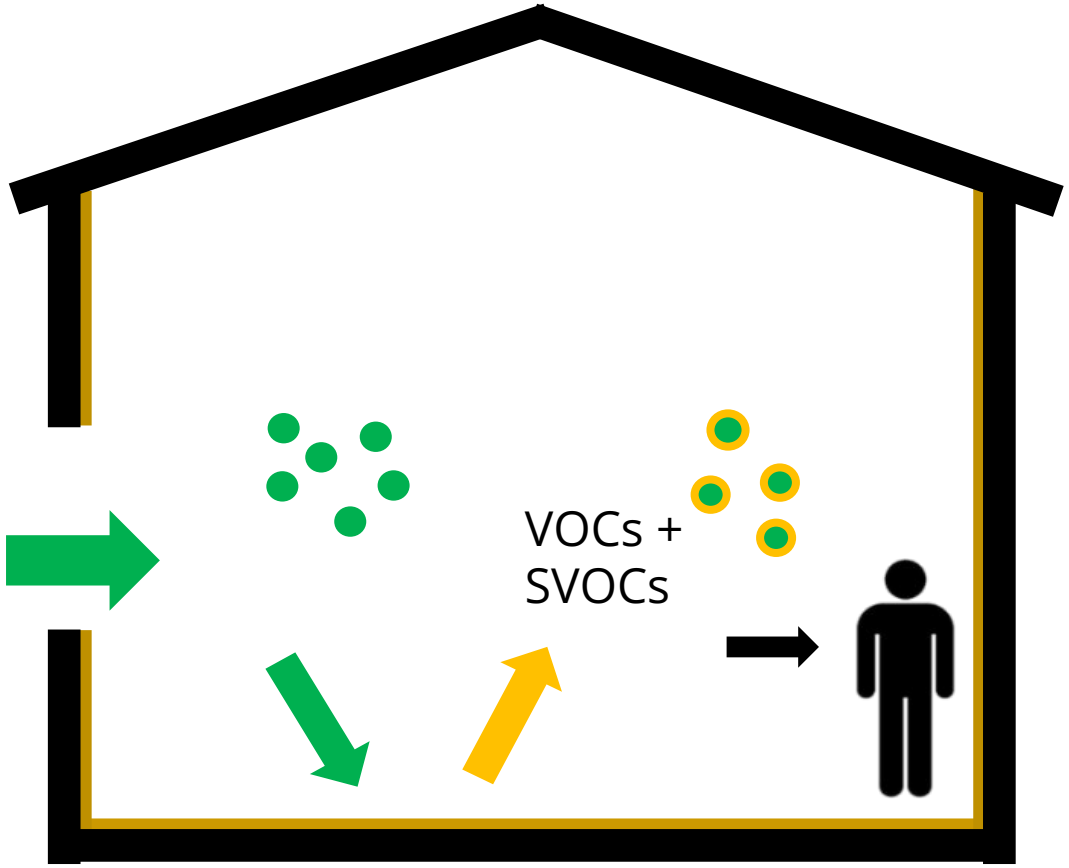
University of Colorado Boulder

WILLIAM & MARY
CHARTERED 1693

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

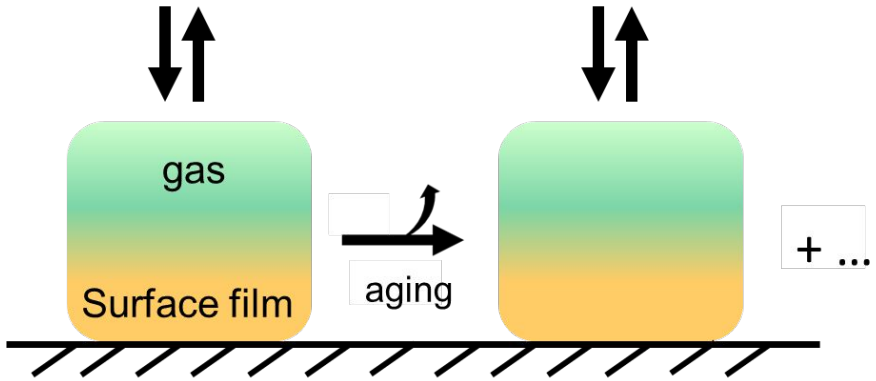
Massachusetts Institute of Technology

Indoor Surface Films



Surfaces indoors become coated with a thin organic film

- Reactive site for SVOC's and VOC emissions
- Film for partitioning



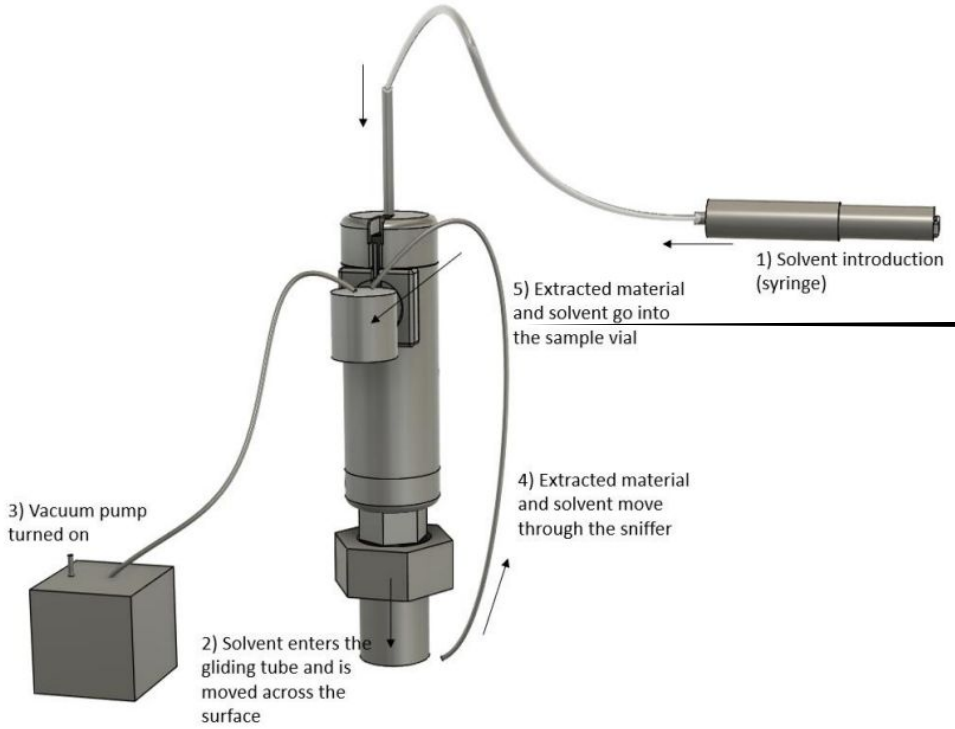
Indoor Surface Films – properties + sources

Cooking

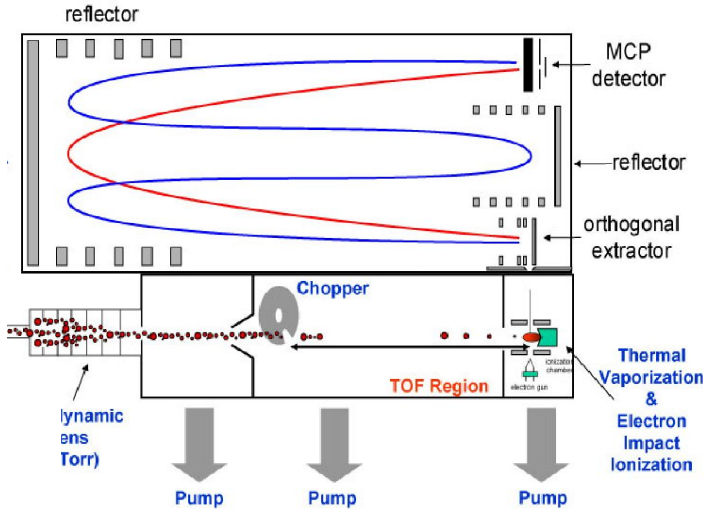
Cleaning

Outdoor transport:
wildfire smoke

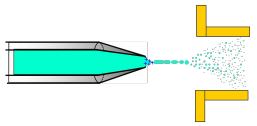
Extraction off surfaces



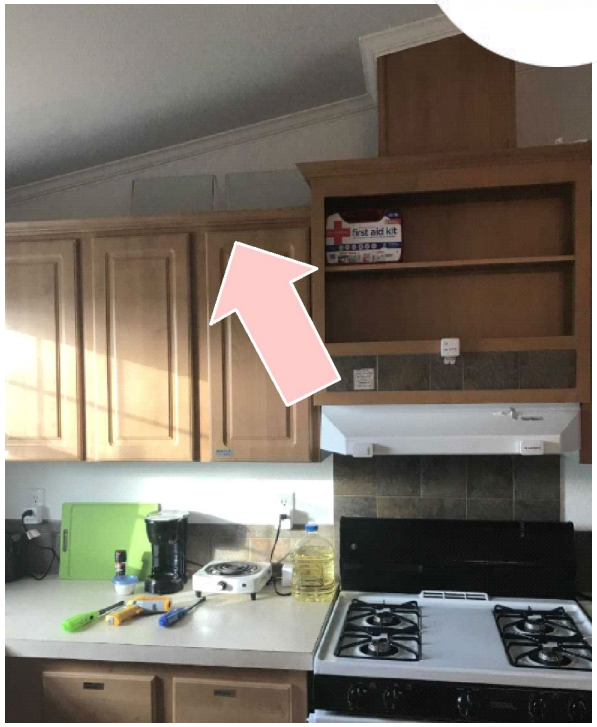
Offline Aerosol Mass Spectrometry



ESI FT/ICR

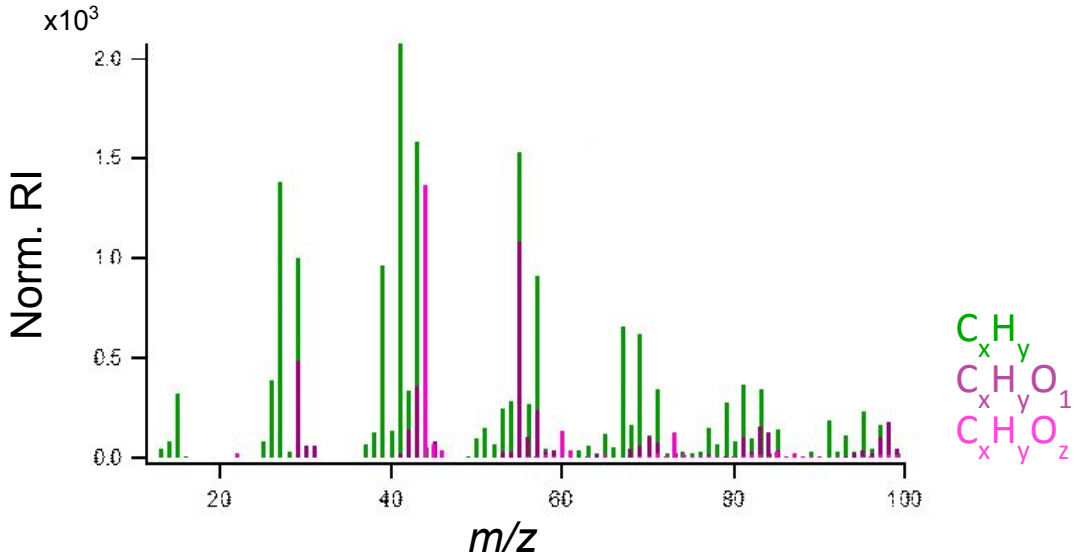


Extraction off surfaces HOMEChem 2018

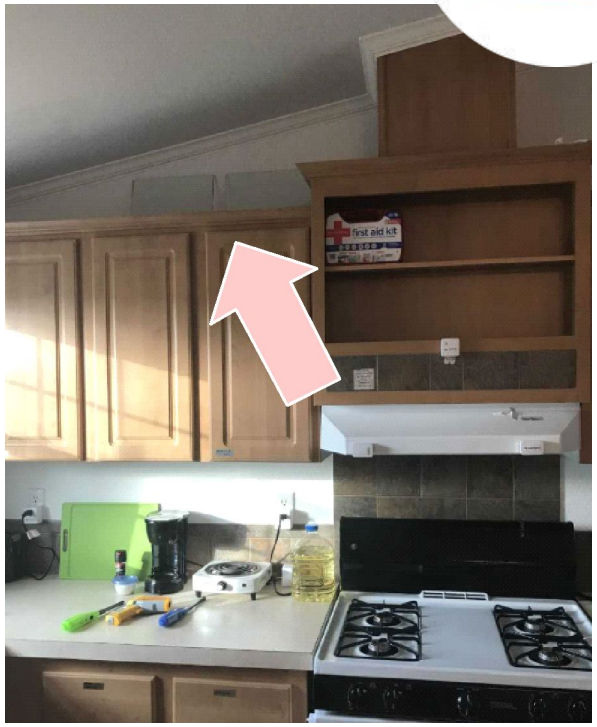


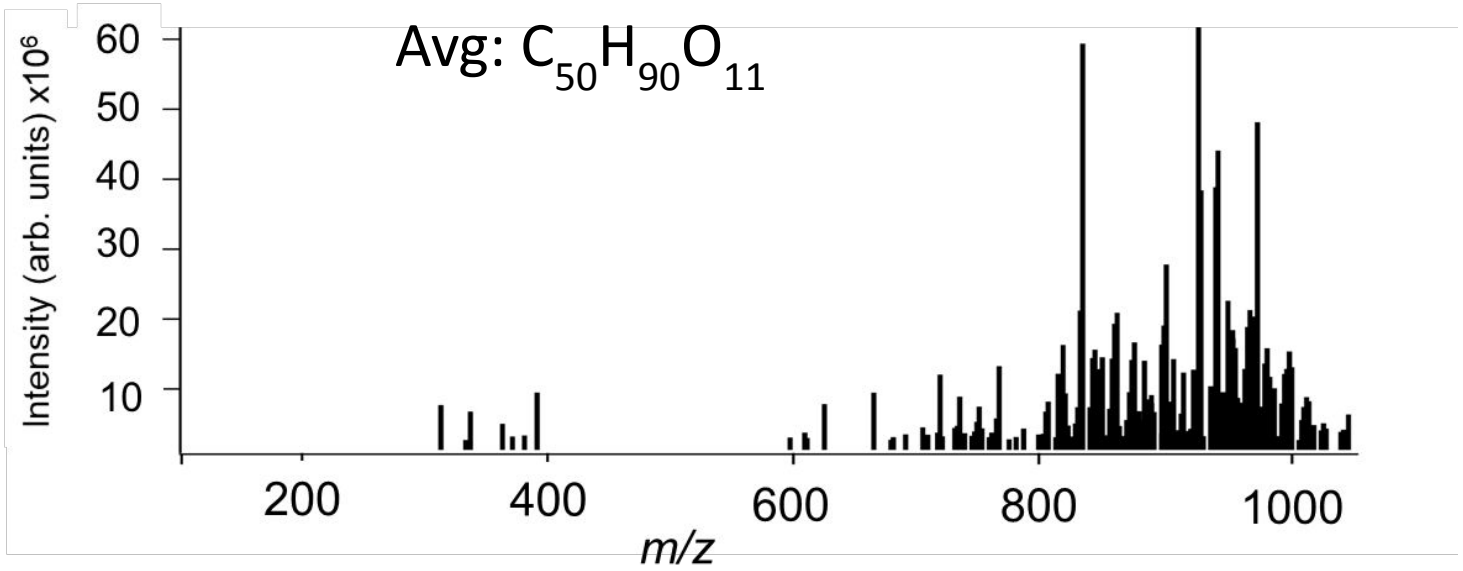
Glass plates, cumulative 3 weeks

Cooking organic aerosol



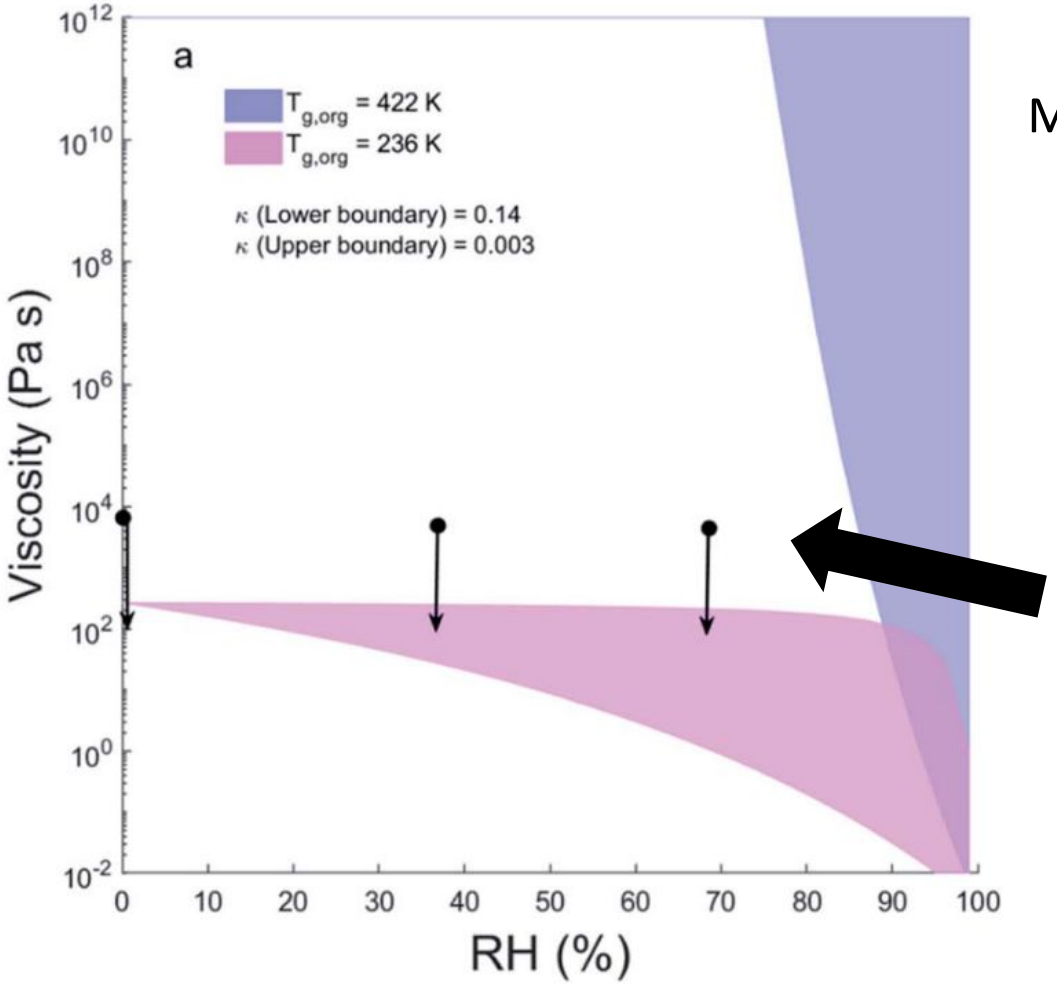
Extraction off surfaces HOMEChem 2018





Glass plates, cumulative 3 weeks

Physical properties of surface film extract



Modeled viscosity (Ying Li, UCI)

Measured viscosity (Kris Kiliand - UBC)

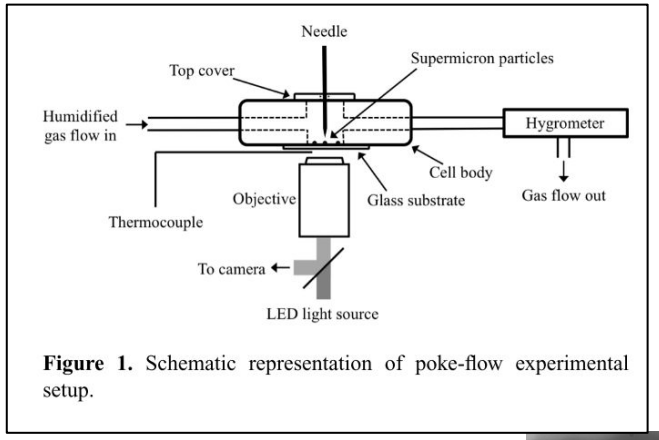
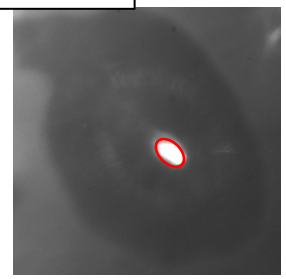


Figure 1. Schematic representation of poke-flow experimental setup.

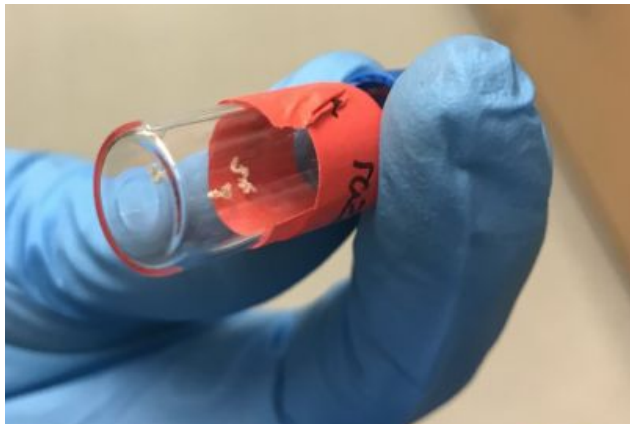


O'Brien et al., 2021

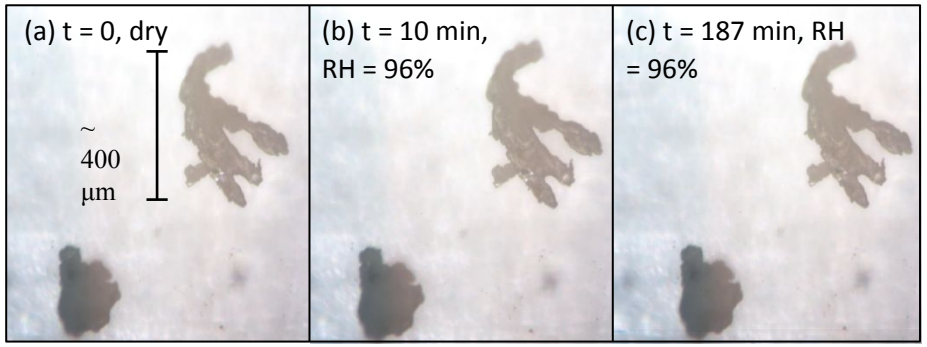
Physical properties □ non-extracted

WM □
Erin Tweed
Christopher Chan
Paul Harris
Churchill Wilkinson

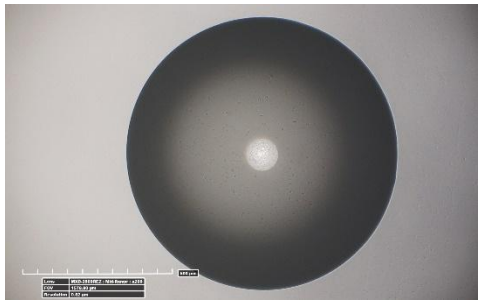
viscous and hydrophobic

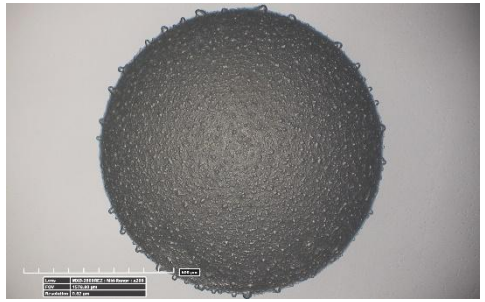


Grapeseed oil



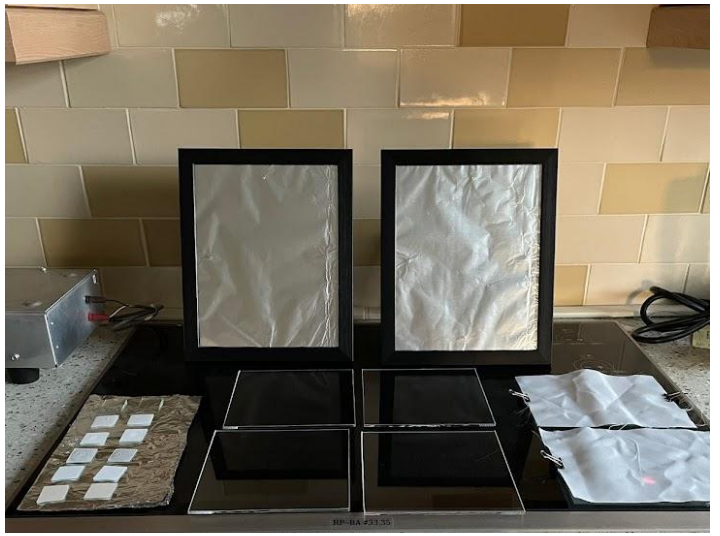
Olive oil, 3-5 ppm ozone, 40 hours

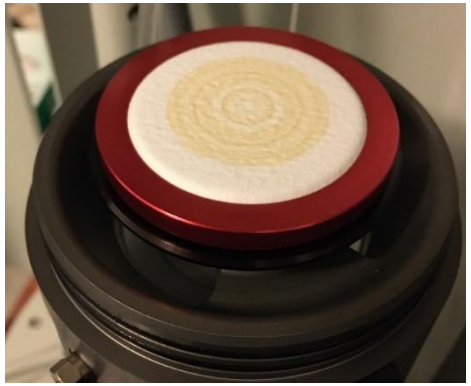




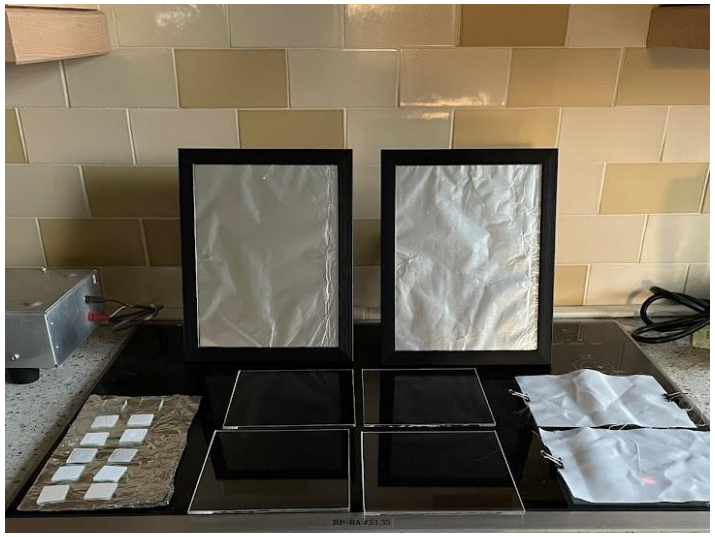
O'Brien et al., 2021

Chemical properties wildfires

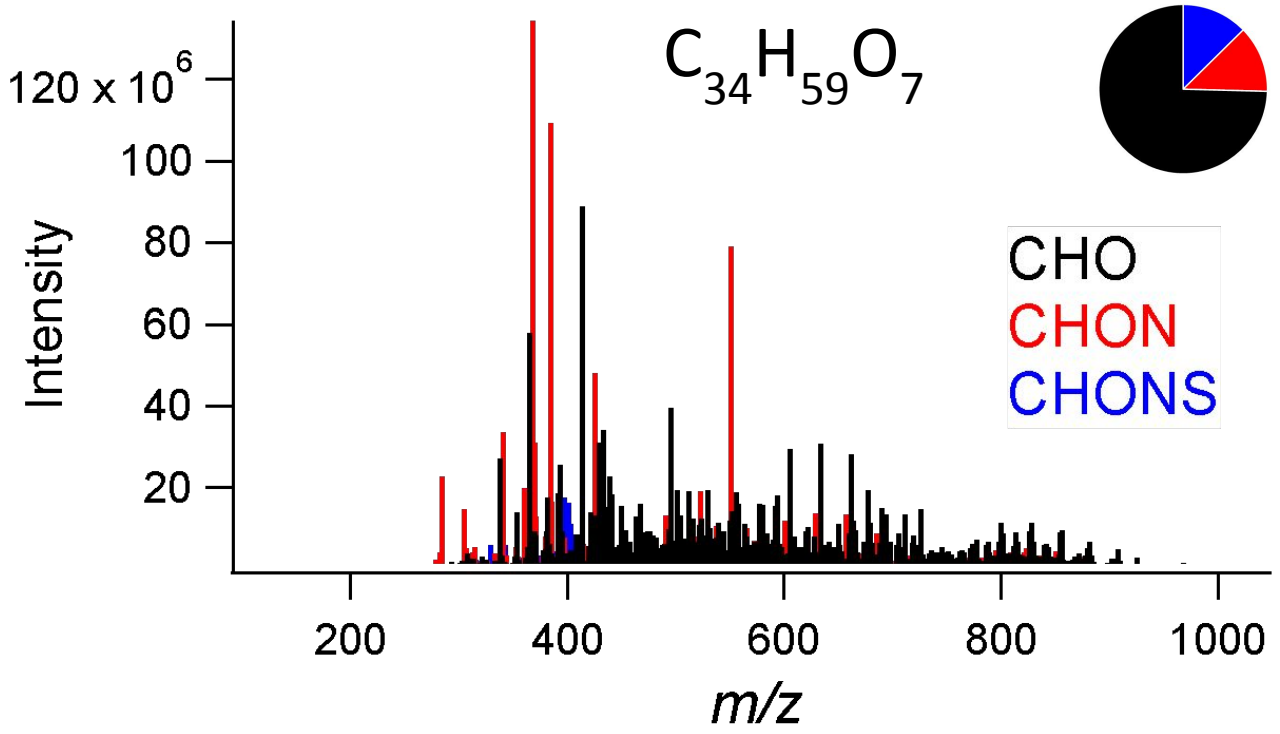




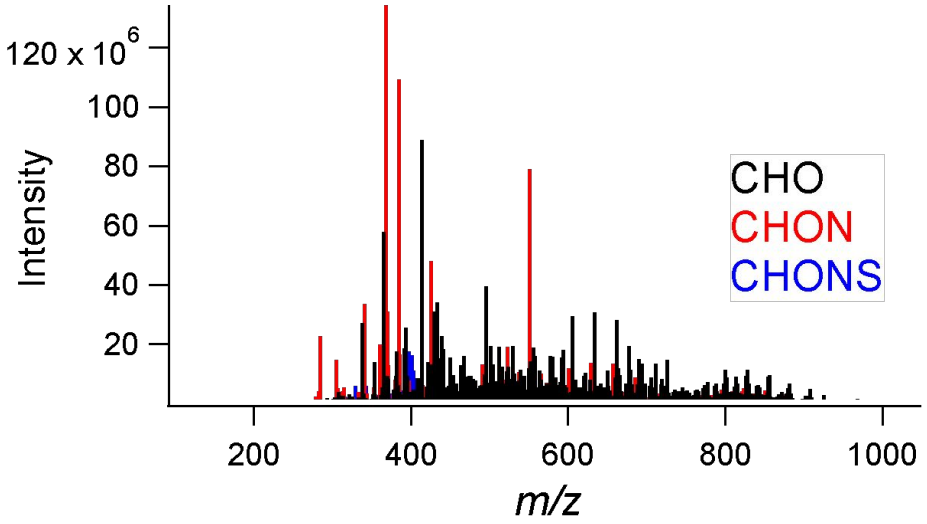
Chemical properties wildfires

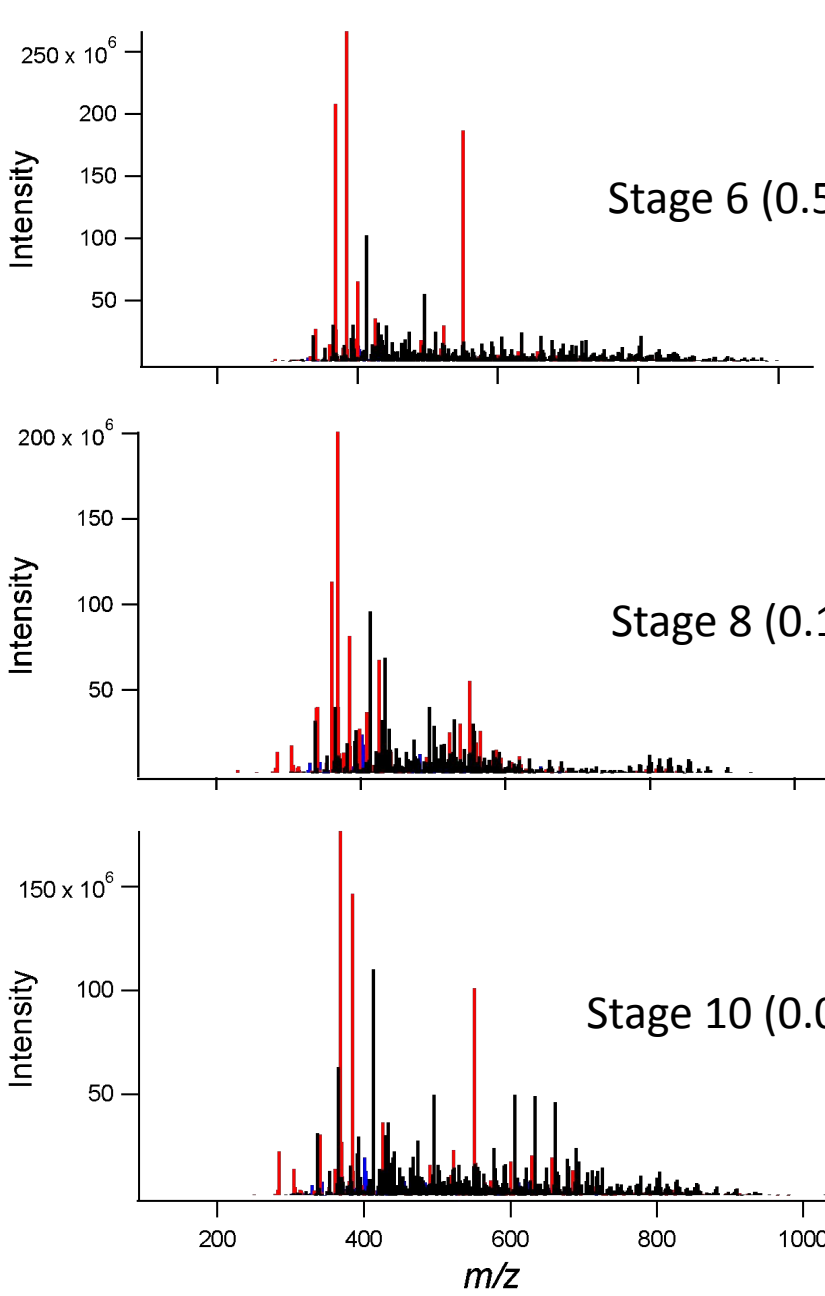


4-day deployment

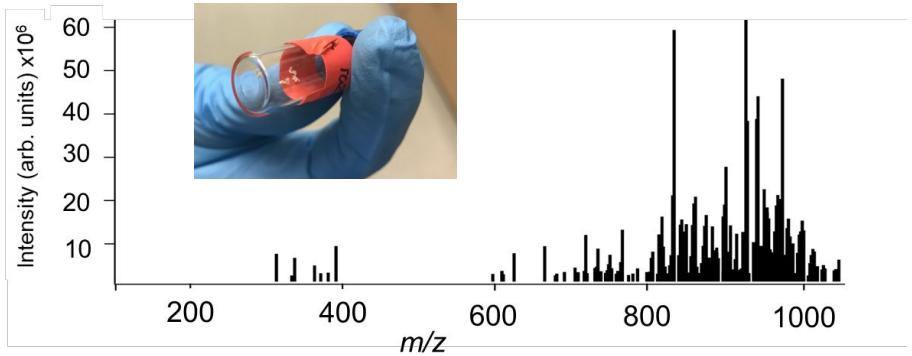


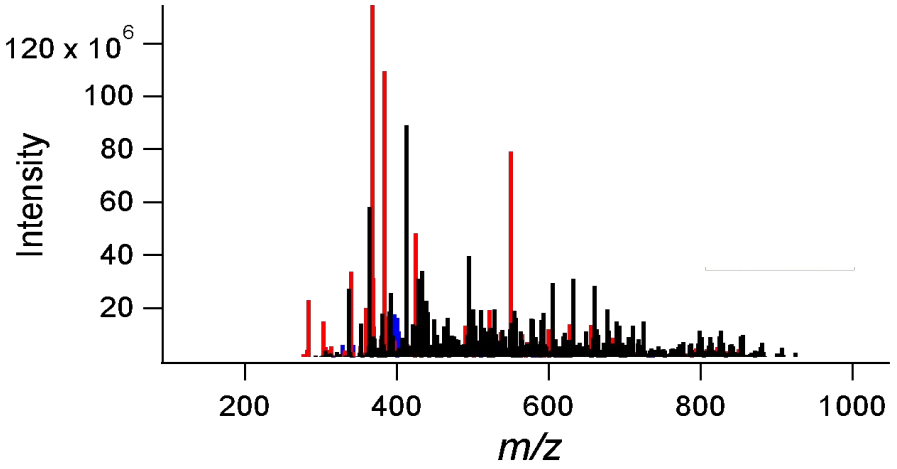
Wildfires


120 x 10^6
100
80
60
40
20
Intensity
200
400
600
800
1000
m/z
CHO
CHON
CHONS


250 x 10^6
200
150
100
50
Intensity
Stage 6 (0.56 μm)
200 x 10^6
150
100
50
Intensity
Stage 8 (0.18 μm)
150 x 10^6
100
50
Intensity
Stage 10 (0.056 μm)
200
400
600
800
1000
m/z

Conclusions





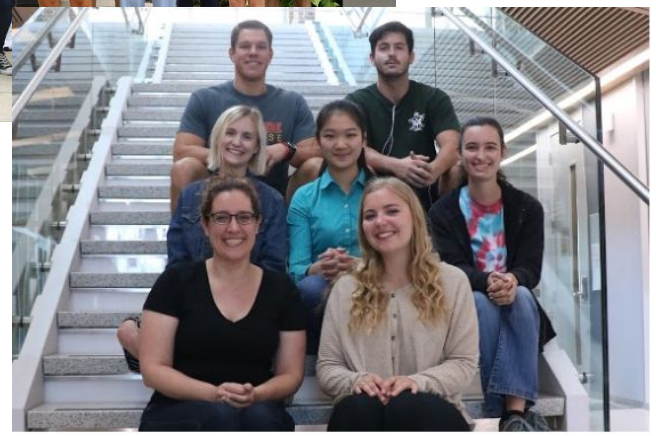
Surface film properties

- Food cooking with oils liquid when deposited but viscous films after aging
- Wildfires wide mass range and minimal changes with shorter ozone aging
- Similarities between aerosol and surface films. We need to expand timescales for aging!

Acknowledgments

ALFRED P. SLOAN FOUNDATION

- Emily Legaard, Hannah Przelomski, Julia Mesawich, Corey Thrasher, Gloria Ge
- HomeChem: Manabu Shiraiwa, Ying Li, Allan Bertram, Kris Kiliand, Victor Or, Vicki Grassian, Erin Katz, Peter DeCarlo
- CASA: Amy Hrdina, Delphine Farmer, Marina Vance, Dustin Poppendieck
- Instrumentation: Jesse Kroll (MIT) for offline-AMS access; Cosmic, ODU for FT-ICR.
- Particle Sizes cleaning spray: Sumit Sankhyan, Marina Vance



University of Colorado Boulder

NIST National Institute of Standards and Technology U.S. Department of Commerce

WILLIAM & MARY CHARTERED 1693

Massachusetts Institute of Technology