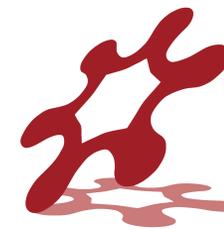


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Microfluidic device for continuous-flow analysis of organics in oldest ice

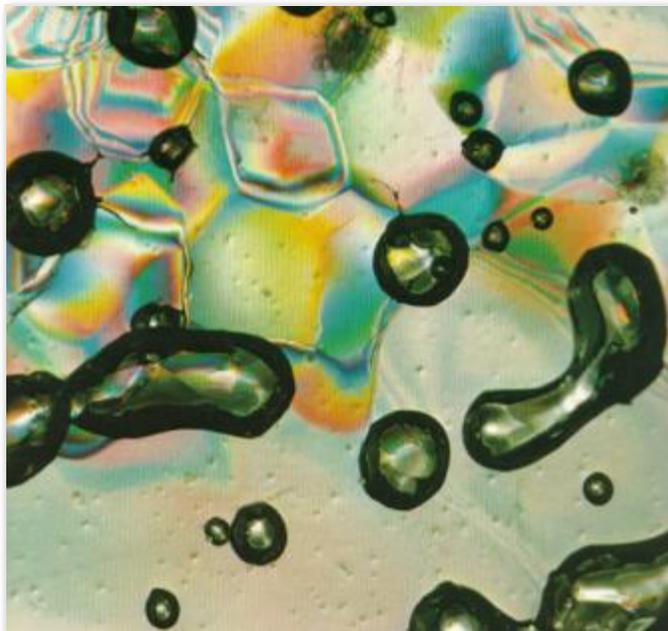
Daniele Filippi, Chiara Giorio

University of Padova, Department of Chemical Sciences, Padova (Italy)

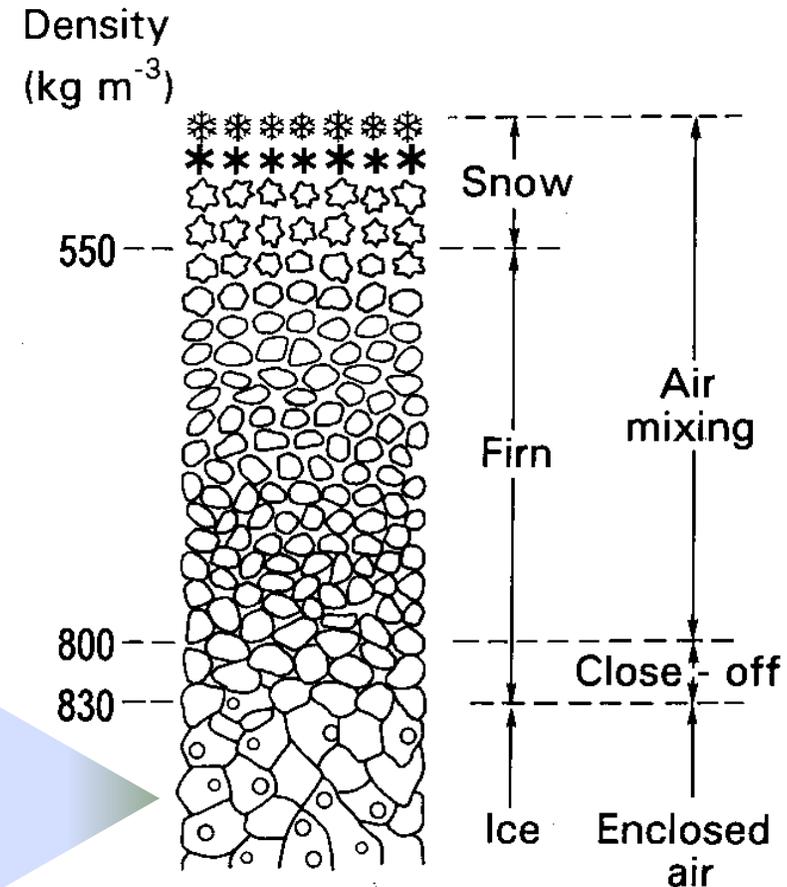


Snow and Ice as archive

- Ice cores are the key paleorecord for the atmosphere
- Data available for the past 800,000 years
- Current quest for oldest ice dating back to ~1.5 Mya
- In the deeper segments the ice is compact so there is little sample availability for a single analysis



Pictures courtesy of Carlo Barbante, 2019



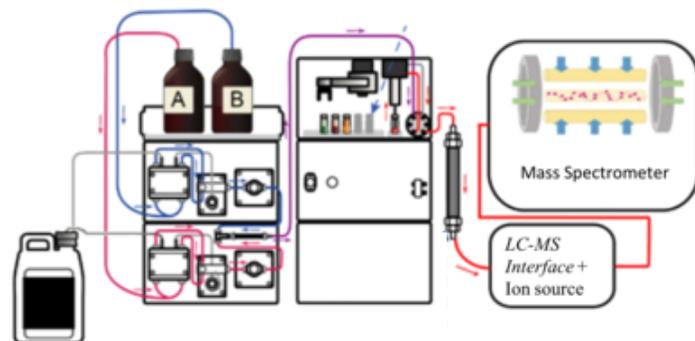
New method for the determination of organics

Development of an innovative microfluidic probe for online method EESI-MS analysis

Traditional method

UHPLC-MS (q-exactive)

direct injection*

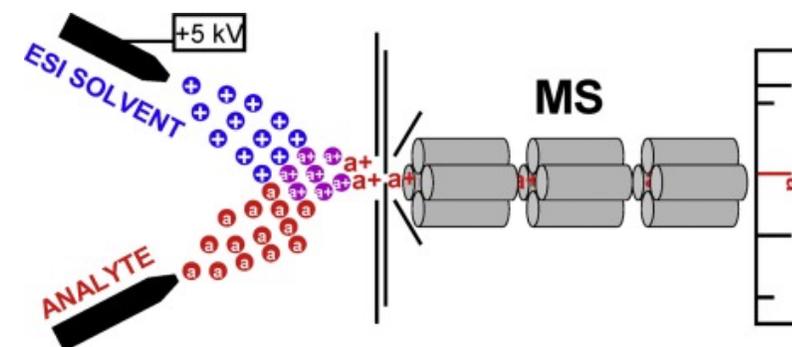


Cons:

- X Long chromatographic run (~30 mins)
- X Pre-concentration may be required
- X Large volume of sample required

New method

Extractive ESI (EESI)-MS

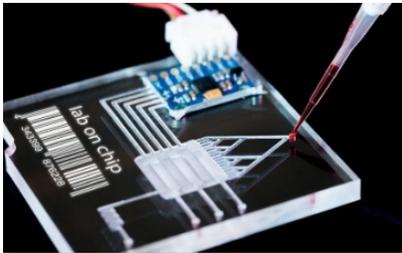


Pros:

- Direct and fast analysis of organic particles
- Preconcentration by solvent evaporation
- Low volume of sample required

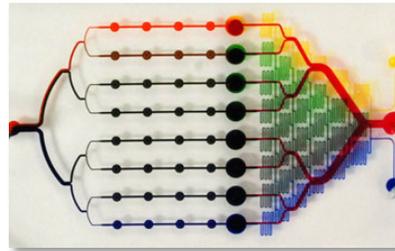
Microfluidics is the science and technology of systems that process or manipulate small (10^{-9} to 10^{-18} liters) amounts of fluids, using channels with dimensions of 10-100 μm

Chemical reactions



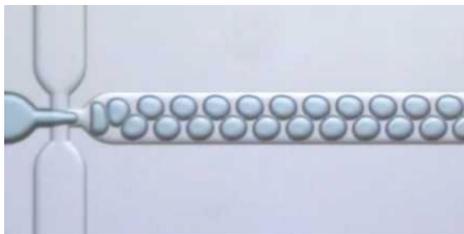
Walter Frei, 2016

Chemical Analysis



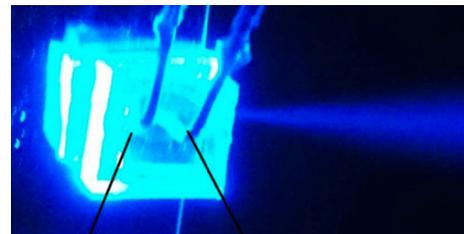
Arum Han, Texas A&M University

Droplets generator



Leti and Araymondlife, 2016

Spray generator



Tadas Kartanas, 2017

ADVANTAGES

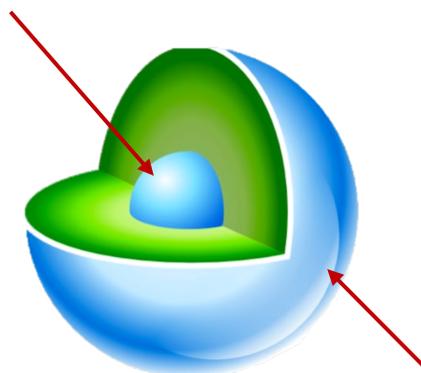
- Accurate measurement, allowing to increase the measurement resolution
- Faster analyses due to the shorter reactions and/or separation times
- Global cost reduction per analysis
- Low reagent consumption
- High throughput and multiplexing
- Portable devices for point-of-care applications

Advantages of microfluidic EESI probe

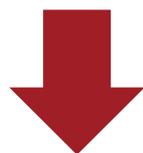
Tolerance to matrix effects ✓

Sensitivity ?

Inorganic core



Organics on the surface



Efficient transfer of the organics to the charged solvent droplets from the ESI probe

Tartaric acid + ammonium sulfate

