Relationship between fuel chemical composition and fuel properties

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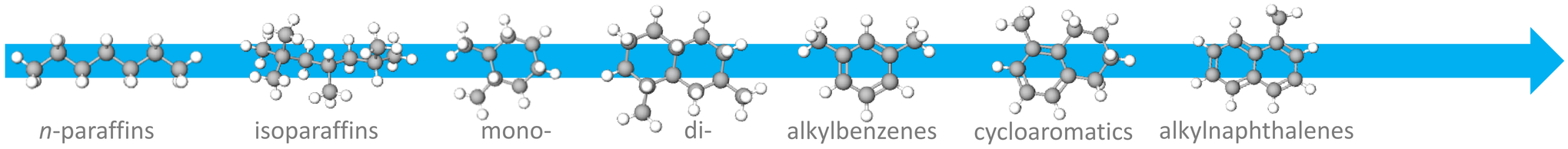
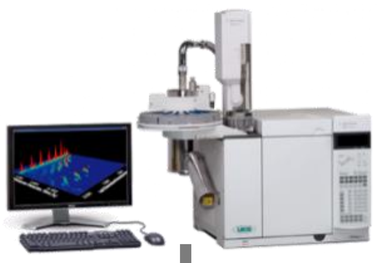
Aviation jet fuels are composed of hundreds of hydrocarbon compounds
Measuring fuel properties is a very time consuming process
Additionally, multiple instruments are necessary for data collection

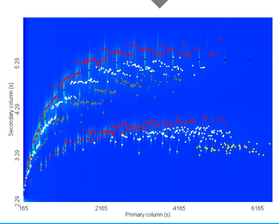


We developed a method for detailed chemical analysis
We developed correlations between fuel chemistry and its properties

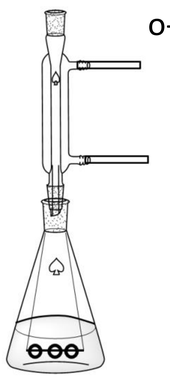
→ density, viscosity, flash point, freezing point, net heat of combustion



two-dimensional gas chromatography with flame ionization detector

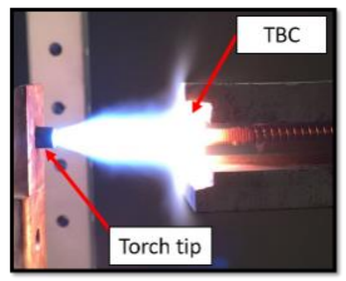


SVM 3001 Stabinger Viscometer



o-ring test rig

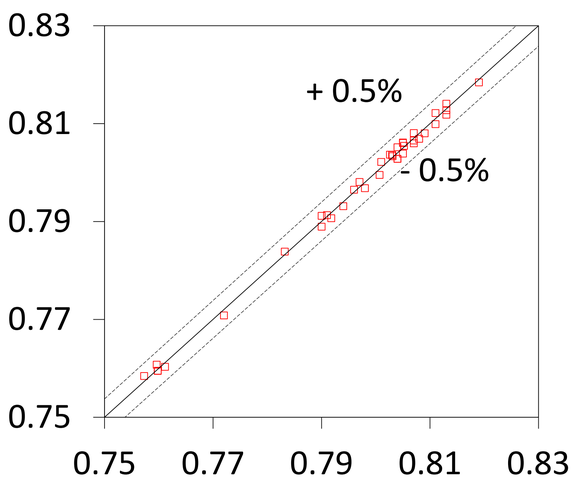
K2970 Freezing Point apparatus



ablation rig

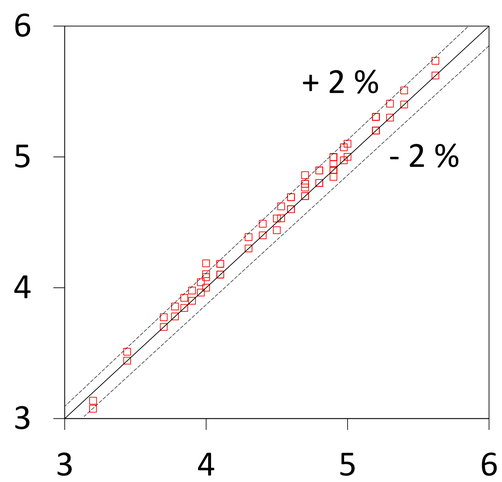
6200 Isoperibol Calorimeter

Density (g/cm³)



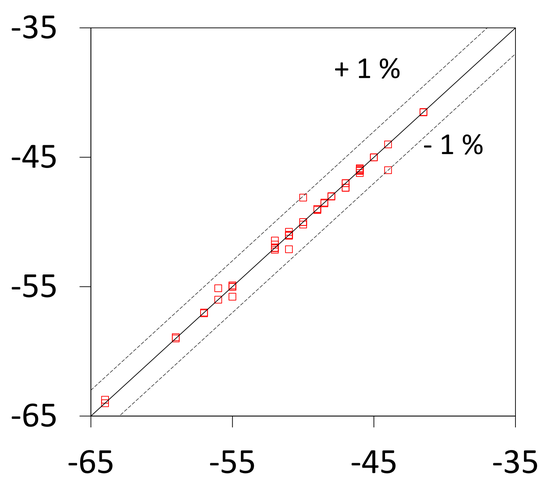
MAPE = 0.11%

Viscosity (mm²/s)



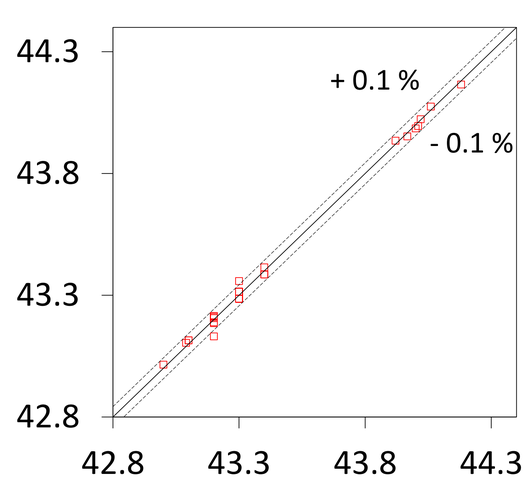
MAPE = 0.30%

Freezing point (°C)



MAPE = 0.66%

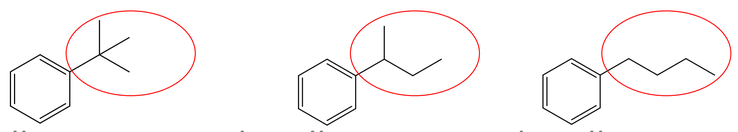
Net heat of c. (MJ/kg)



MAPE = 0.04%

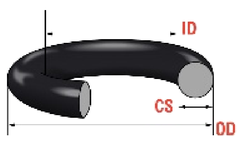
x-axis: measured value; y-axis: predicted value; MAPE: mean absolute percentage error

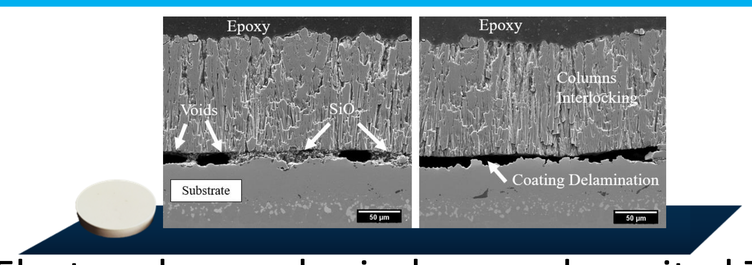
The steric effects of alkyl chains attenuate the propensity to swell o-ring seals



	tert-butylbenzene	sec-butylbenzene	*n*-butylbenzene
swell (vol. %):	0.68	0.86	1.37

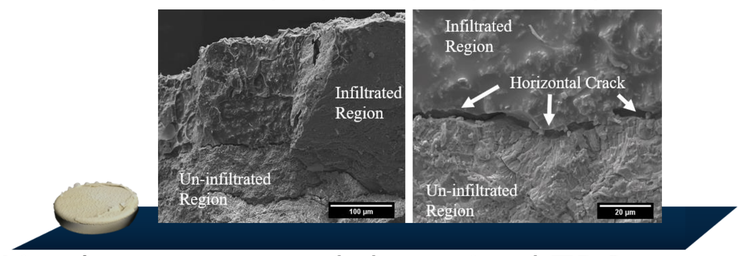
The volume swell percent and tensile strength of o-rings are reversible properties





Electron beam physical vapor deposited TBC

Full infiltration of impurities
Delamination at interface



Air plasma sprayed deposited TBC

Partial impurities infiltration
Cracks across TBC
Delamination in layers