



ESDU SPA-M4-2

Advances in characterising asphaltenes combining macro- and micro-ATR-FTIR imaging

Unamended
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Les Rencontres Scientifiques de l'IFP

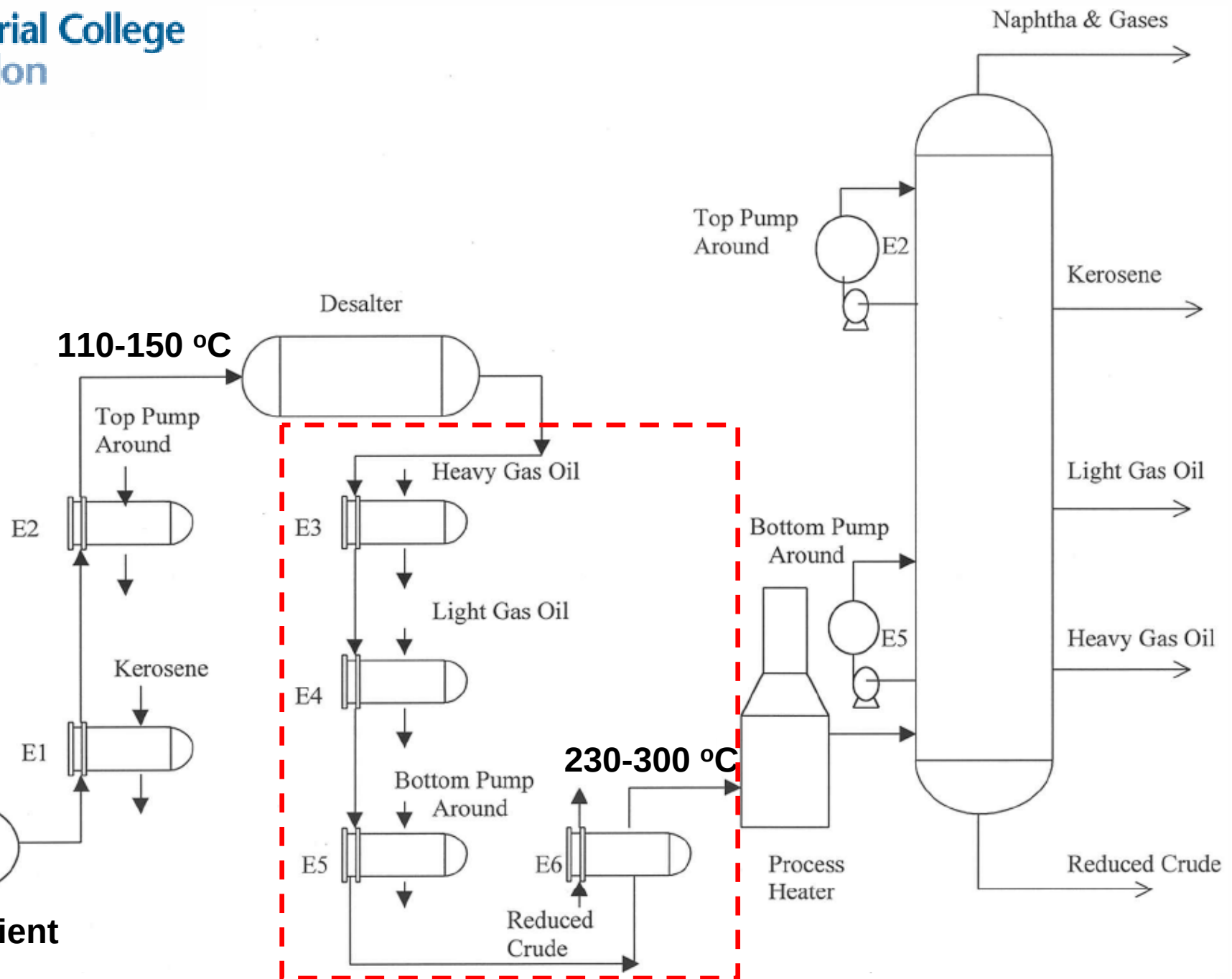
*Molecular Structure of Heavy Oils
and Coal Liquefaction Products*

12 - 13 April 2007, IFP-Lyon, France



CRude Oil Fouling project (CROF)

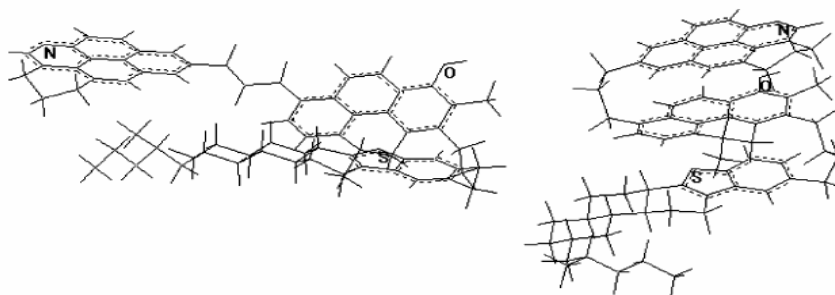
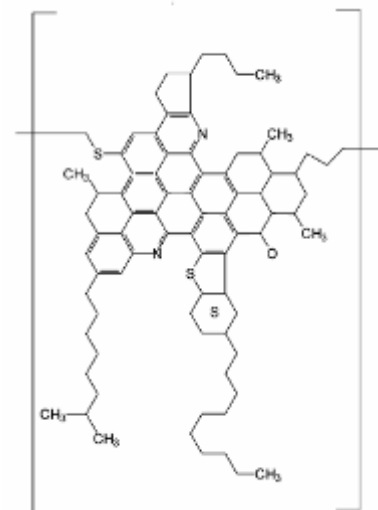
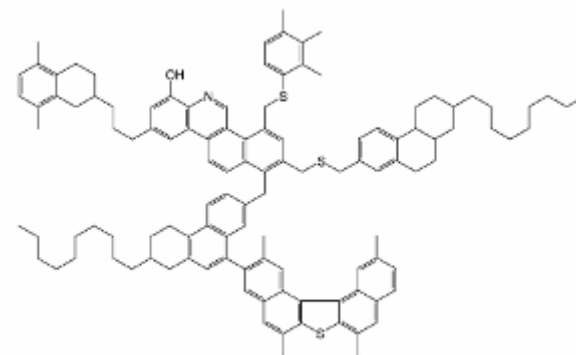
- Sub-Project A: Characterisation of asphaltenes and of deposited foulants
- Sub-Project B: Interfacial and rheological properties
- Sub-Project C: Fundamental transfer processes
- Sub-Project D: Thermodynamics and molecular modelling
- Sub-Project E: Stirred vessel fouling tests
- Sub-Project F: Annulus flow tests
- Sub-Project G: Control and mitigation
- Sub-Project H: Technology transfer



Schematic diagram of typical crude distillation unit (*Panchal and Huang, 2000*)

Content

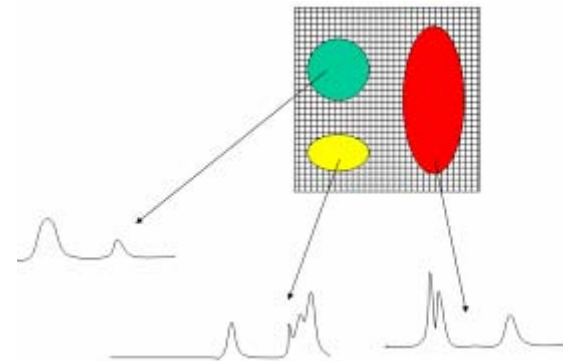
- Motivation of project
- Infrared spectroscopic imaging
- Macro-imaging results
- Micro-imaging results
- “Chemical movie”
- Conclusion and further work



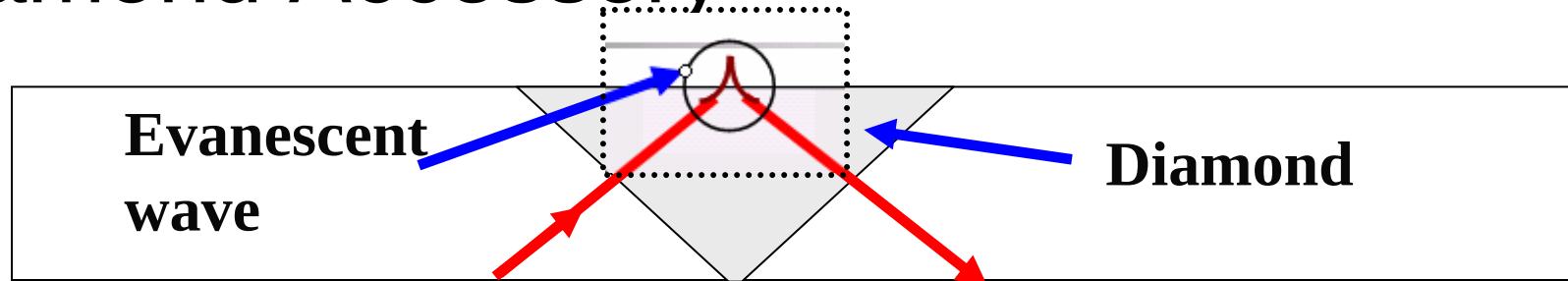
Acevedo, S., et al, 2007, Energy and Fuels 21 (4): 2165-2175

Why Fourier-Transform IR (FTIR) Spectroscopic Imaging?

- Chemical specificity
- Analyses solid, liquid and gas
- Fast and non-destructive
- Dynamics study (temperature, pressure, etc.)
- Better selectivity



Attenuated Total Reflection (ATR) - Diamond Accessory



$$d_p = \frac{\lambda}{2\pi n_1 \left(\sin^2 \theta - \left(\frac{n_2}{n_1} \right)^2 \right)^{0.5}} \quad (d_p \sim <1 \text{ microns to few microns})$$

- Study aqueous samples and corrosive materials
- Mechanical strength allows compression
- Reproducible results
- Ease of cleaning