Department of physical and colloid chemistry

Dispersions
(**P**etroleum **D**isperse **S**ystems)

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Introduction

- The word “petroleum”

  derived from the Latin “petra” and “oleum”, means literally rock oil
- **Oil** («mountain oil») is a liquid mixture of different hydrocarbons (...). [Brokgauz and Efron]
- **Oil** («neft» [persian]) Is a burnable, oily liquid with a specific smell, which is an important mineral. . [Big Soviet Encyclopedia]

Organization course structure (road map)

- Lectures (9 lectures)
- Practice (4 laboratory works)
- 3 Tests

Content:

The following themes will be discussed:

№	The title	Test
1	Classification PDS. Surface and inter phase phenomena	1
2	Phase transitions	
3	Colloid-chemical properties of PDS, nanosized effects	2
4	Physico-chemical mechanics and PDS rheology	3
5	Chemicals as composite PDS	

Laboratory works:

№	The title of Laboratory work
1,2	Optical method for investigation of PDS (size of particles, onset)
3	Definition of PDS kinetic stability
3a	De-emulsification of crude oil
4	Various types of emulsification
5	Rheometric test of hydro-fracturing (HF) gels

Rating

№	Action items	Quantity	Points	Summing up min	max
1	Attendance	9	-	0	30
2	Test	3	7 -10	21	30
3	Laboratory works	4	6 -10	24	40
Total				45	100

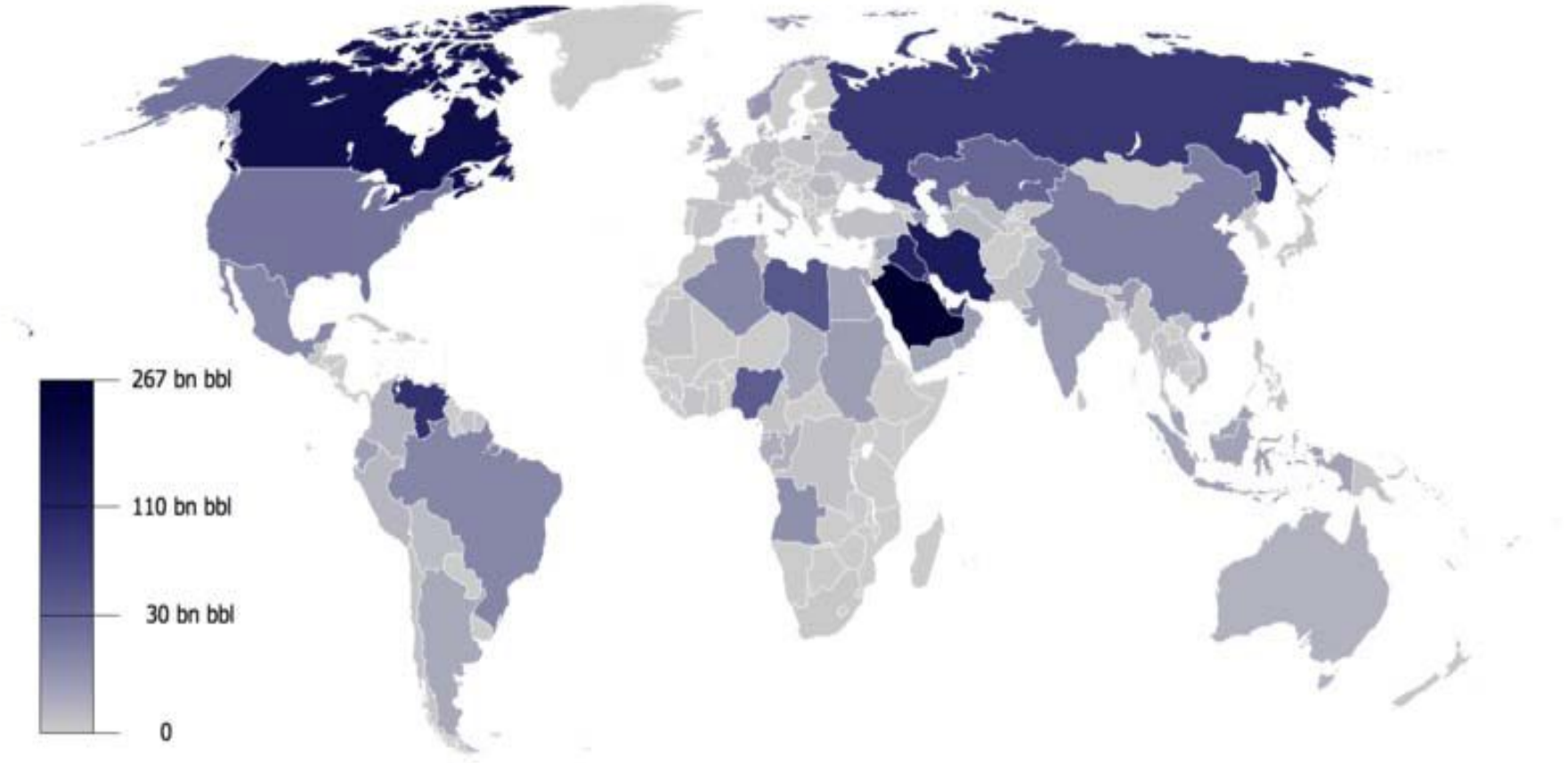
*Petroleum (**Oil**) Disperse Systems in oil and gas cycle*

- Short brief from chemistry in oil
- Two approaches to research of the P(O)DS

Examples of hydrocarbon systems

From "Petroleomics lecture"
Oliver C. Mullins *(Schlumberger-Doll Research)*: oil samples

Proven oil reserves in the world, as published by the CIA Fact book, 2009



Classification of various kinds of hydrocarbonic raw material (Abraham H., 1929)

Hydrocarbonic raw material	Coke ability, % (mass.)	Density, kg/m^3	Cinematic viscosity under 20 °C, mm^2/sec	Maintenance, % (mass).	
				Resins and asphal-tenes	asphal-tenes
Oils	< 8	<0,91	8 – 450	10-20	<5 – 6
Hard oils	8 – 12	0, 91 –0,98	450 – 850	20-35	4 – 10
Malta *	13 – 25	0,98–1,038	850	35-60	10 – 25
Native bitumen	>25	>1,03	–	60-98	>25

* Malta is the oxidized oil representing semisolid substance with raised maintenance of resins and asphaltenes; meets in the collectors approached to a zone of water-oil contact

Two approach to PDS research

- **Analytical**

-Definition of chemical analysis of oil

-Identification of fractions

- Fingerprinting

Colloid-chemical

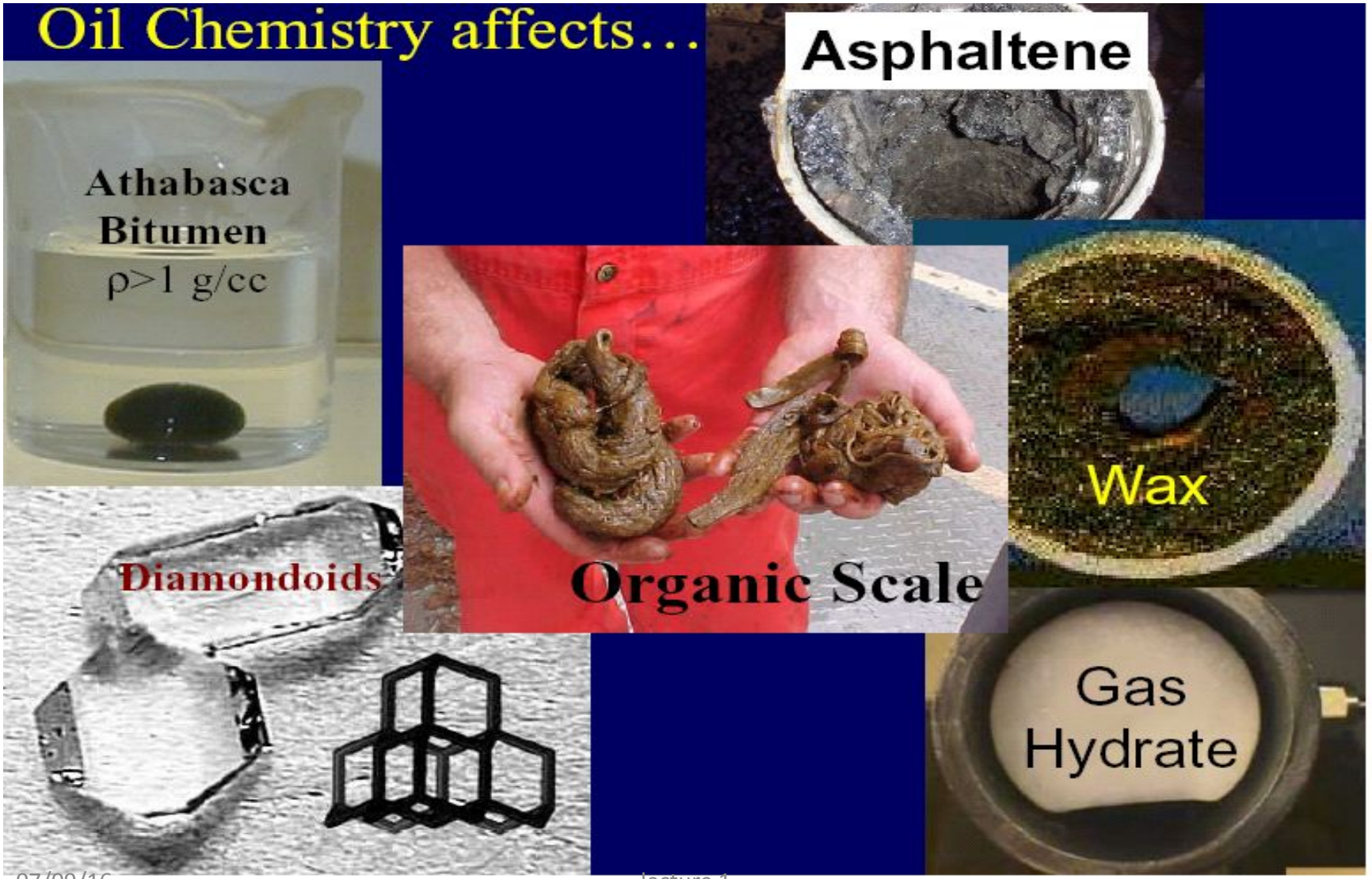
- Microstructure PDS analysis

- Change of phase in PDS

- Property PDS regulation with pro-dosed external actions

From “Petroleomics lecture”

Oliver C. Mullins *Schlumberger-Doll Research*



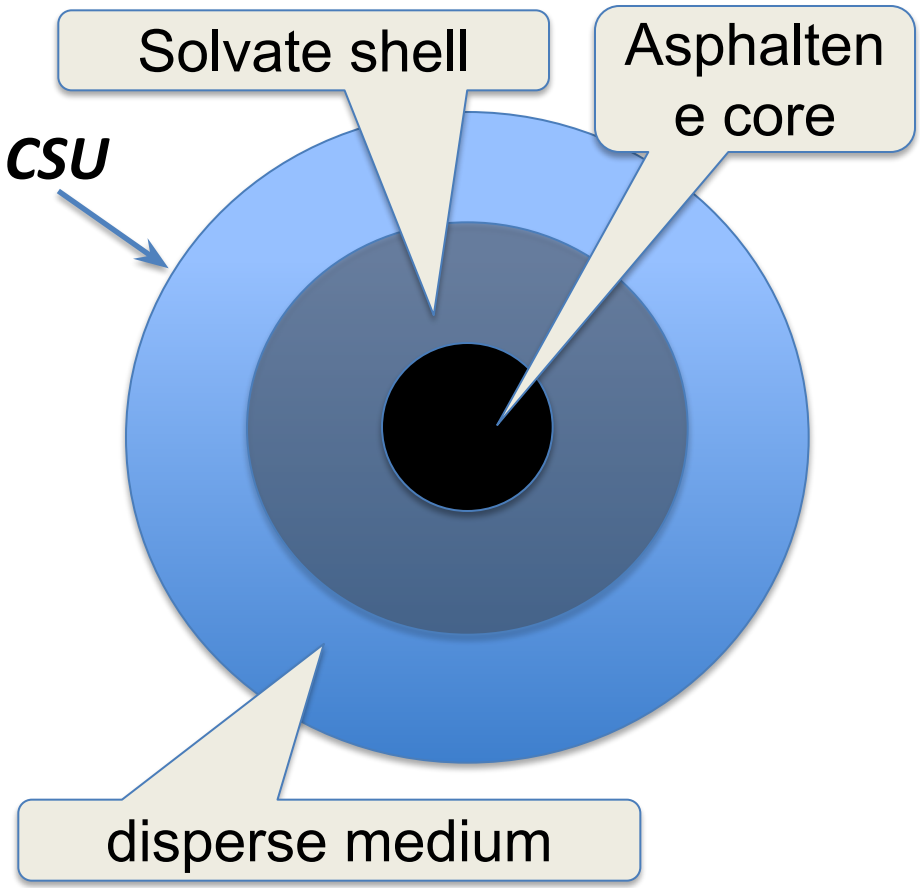
«If you want to understand the function, you have to learn the structure»

F.Krik, **Nobel Prize Winner**

Dispersion is the heterogenetic system, in which one phase is represented by small size particles - about 1 nm to 10 microns.

Petroleum (Oil) disperse systems P(O)DS

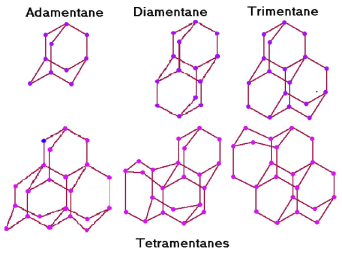
Complex structural unit (CSU)

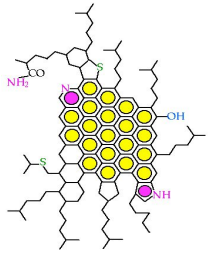


Some facts from the history of PDS

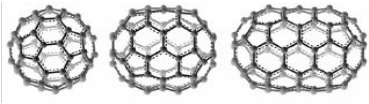
- Abragham (1929)
- Pfeiffer (1953)
- Yen (USA,1961)
- Rebinder, Syunyaev (Russia,1971)

Oil disperse systems (ODS)





Asphaltenes, fullerenes

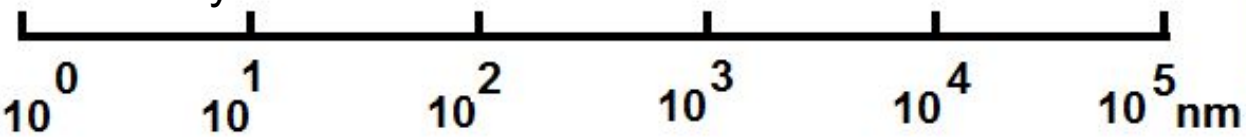


C_{60} C_{70} C_{90}

Diamondoids,

Gas hydrates zeolite, oils, catalysts

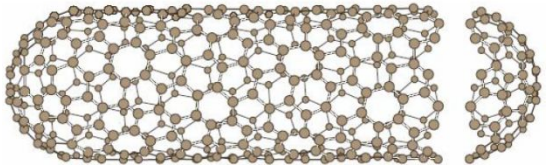
crude oils

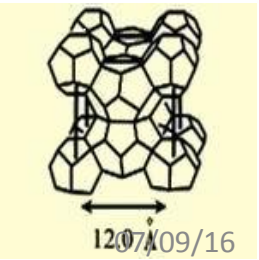


Macrophase region

Asphaltene-containing dispersions (oils, bitumen, oil residues)

Carbon nanotubes





Chemical agents (drill fluid, gels, acid and alkali compositions)