Applied Rheology

Laboratory

List of exercises

1. **Rheological properties of Stokes fluids**
2. **Investigation of rheological properties of fluids with yield stress**
3. **Qualitative determination of fluid properties using Höppler reoviscometer**
4. **Study of rheological properties of liquids in capillary rheometer**
5. **Determination of viscosity of fluids using capillary viscometers**
6. **Determining the swelling degree of polymer solution jet**

Week / Group	I	II	III	IV	V	VI
A	**1**	**2**	**3**	**4**	**5**	**6**
B	**2**	**3**	**4**	**5**	**6**	**1**
C	**3**	**4**	**5**	**6**	**1**	**2**
D	**4**	**5**	**6**	**1**	**2**	**3**
E	**5**	**6**	**1**	**2**	**3**	**4**
F	**6**	**1**	**2**	**3**	**4**	**5**

Time outline

Week	Date	Comment
O	**9-04-2013**	
I	**16-04-2013**	
II	**23-04-2013**	**30 min test**
III	**30-04-2013**	
IV	**7-05-2013**	
V	**14-05-2013**	
VI	**21-05-2013**	**45 min test**
VII	**28-05-2013**	**lab makeup**
Extra week	**4-06-2013**	

Applied Rheology

Key issues required at each laboratory exercises

(the basic knowledge about following issues is obligatory on each laboratory exercise)

1. Simple shear:
    - Hooke's law
    - Newton's law
2. Flow curve and viscosity curve
3. Definition of dynamic and kinematic viscosity
4. Influence of temperature and pressure on rheological properties
5. Non-Newtonian fluids: definition, classification of fluids, general concept of Newtonian fluids
6. Flow curves and basic rheological models of rheostable fluids, e.g. Ostwald-de Waele model, Bingham model and Herschel-Bulkley model.

Applied Rheology
Test issues

1. Elastic, viscous and viscoelastic response.
2. Simple shearing:
    - Hooke's law – simple shearing of elastic solid
    - Newton's law – simple shearing of fluid
3. Definition of dynamic and kinematic viscosity.
4. Influence of temperature and pressure on rheological properties.
5. Non-newtonian fluids: definition, allocation of fluids, general concept of Newtonian fluids.
6. Basic rheological models of rheostable fluids, e.g. Ostwald-de Waele model, Bingham model and Herschel-Bulkley model. Especially flow and viscosity curves.
7. Phenomena of shear-thickening and shear-thinning.
8. Fluids with yield stress (focus on reasons of this phenomenon).
9. Fluids with rheological properties dependent on time of shearing (thixotropy and antithixotropy mechanism)
10. Characteristic of viscometers: Ubbelohde, Cannon-Fenske, Ostwald and Höppler.
11. Models describing viscoelastic fluids.
12. Effects of normal stress (Weissenberg effect, Barusa effect).
13. Mechanical models of fluids (Maxwell, Kelvin, Burgers models).
14. Electroreological and magnetorheological fluids.
15. Falling of single solid particle (settling velocity, drag force on a sphere).
16. Capillary rheometry – basic equations (velocity profile, bulk velocity, Coriolis coefficient for Newtonian fluids).
17. Rotational rheometer.

Literature

1. Chhabra R. P. & Richardson J. F., Non-Newtonian Flow in the Process Industries. Fundamentals and Engineering Applications. Butterworth-Heinemann, 1999.