CHEM-E6140: Fundamentals of Mineral Processing and Recycling

prof. Rodrigo Serna

NOTE: One personal cheat-sheet allowed for consultation, please return with exam
Use of MS Excel is allowed. Return excel files to *rodrigo.serna@aalto.fi* and *jari.aromaa@aalto.fi* via email before leaving the exam.
Consulting the internet or equivalent is strictly forbidden.
Calculators are permitted

1. A mineral sample from a concentrate in a potentially new mining site contains three main phases: chalcopyrite (CuFeS2), pyrite (FeS2), and non-sulfides (containing no Cu or Fe). If the Cu concentration is 22,5% and the Fe concentration is 25,6%, what is the concentration of chalcopyrite, pyrite and non-sulfides? (5 points each)
(Molar masses (g/mol) are: Cu = 63,5; Fe = 56; S = 32)

2. The results of particle size distribution after grinding a sample of mineral extracted from this potential new mining site are shown below. Generate a distribution function based on the Gates-Gaudin-Schumman model and provide a d_{50} value for this population (15 points)

Sieve size	Mass retained in sieve (g)
>250	7,65
180-250	13,35
125-180	29,25
90-125	37,8
63-90	33,6
45-63	19,5
<45	8,85

3. After grinding the chalcopyrite-containing mineral from problem 1, it is mixed with water to produce a slurry containing 12% of solids in a stirred tank. The mineral slurry needs to be transported from the stirred tank to a preparation tank right before the concentrator. If the flowrate of slurry is 120 ton/h determine the pumping power required (in KW) (30 points).

- The total pipe length between the stirred suspension tank and the preparation tank is 500 m and the concentrator is 20 m higher than the stirred tank (the presence of instruments and corners in the pipeline is negligible)
- The pipe is made of steel and has an inner diameter of 12 cm
- The solid density of the mineral is 2,8 ton/m^3
- The slurry's viscosity is 0,9 cp and it can be assumed to behave as a Newtonian fluid

4. The following data of specific gravity was obtained for the chalcopyrite-containing mineral. Produce separability curves for chalcopyrite and gangue (10 points). Assuming all Cu is found in the form of chalcopyrite:

- With which property set-point could we recover 90% of Cu? (15 points)
- What is the best Cu grade achievable with this recovery? (15 points)

Specific gravity	Total Mass Distribution (%)	Mineralogical Analysis, CuFeS2 %
<2,55	1,57	0,01
2,55-2,60	9,22	0,12
2,60-2,65	26,11	0,12
2,65-2,70	19,67	0,12
2,70-2,75	11 ,91	0,49
2,75-2,80	10,92	0,98
2,80-2,85	7,87	1,07
2,85-2,90	2,55	3,76
>2,90	10,18	27,74

Diagrams

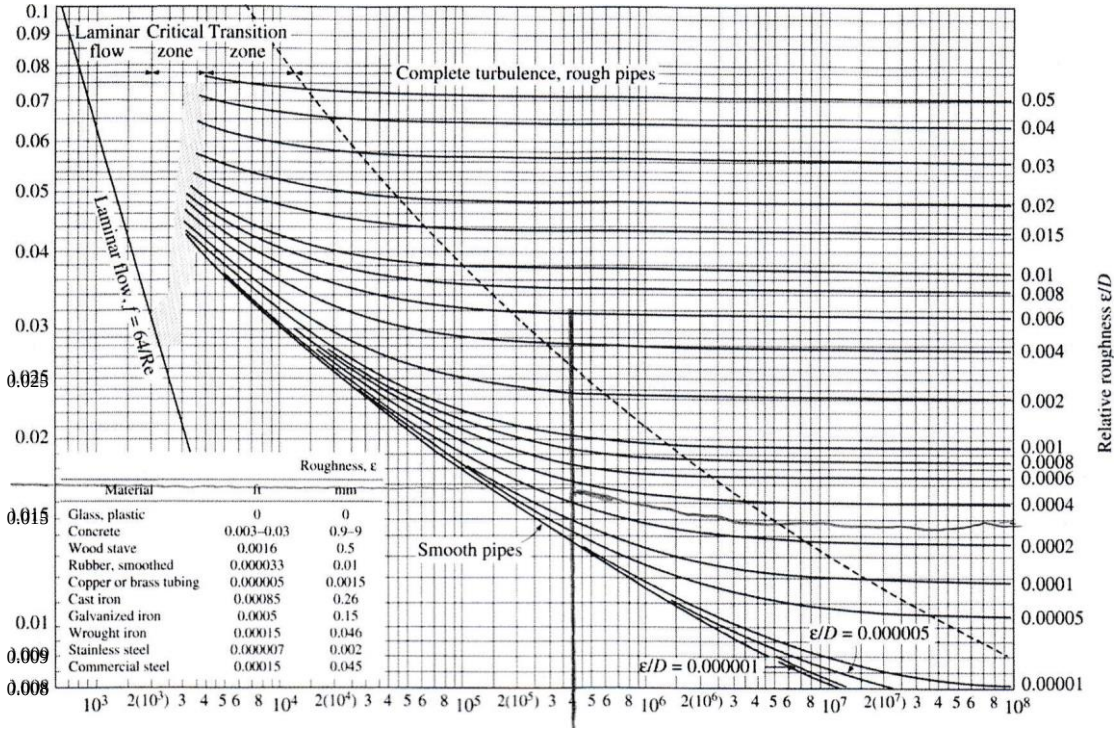

FIGURE A.27

The Moody chart for the friction factor for fully developed flow in circular tubes.