

Materials science

Mechanical properties of surfaces and interfaces

IDENTIFICATION

CODE : GM-4-S2-EC-PCSRF
ECTS : 2.0

HOURS

Lectures : 12.0 h
Seminars : 8.0 h
Laboratory : 8.0 h
Project : 0.0 h
Teacher-student
contact : 28.0 h
Personal work : 20.0 h
Total : 48.0 h

ASSESSMENT METHOD

2-h examination + report and/or
presentation on practical works

TEACHING AIDS

Manuscripts of courses, exercise
lessons and practical works

TEACHING LANGUAGE

French

CONTACT

M. CHARMEAU Jean-Yves
jean-yves.charmeau@insa-lyon.fr

AIMS

Knowledge of basic physicochemical mechanisms, physical mechanisms and parameters governing surface and interface phenomena (adhesion / adhesion, surface analysis, surface treatment)

Application to surfaces of polymers and inorganic materials

CONTENT

A) Physico-chemistry of surfaces and interfaces:

A-1) General Definitions: Surface, Interface - Surface layer, Interphase - Wettability, Adhesion and adhesion

A-2) Basic aspects of surface energies: Intuitive notions of surface tension for liquids - Thermodynamic modelling of interfaces - The different interactions and forces involved: Inter-atomic bonds - Intermolecular bonds

A-3) Static and dynamic surface tension measurement techniques: Liquid case - Solid case - Theories: Mechanical theory - Theories concerning specific adhesion; The most recent developments: the theory of acid / base interactions - Multiscale developments

B) Measurements and Mechanical Control of Adherence:

B-1) Non-destructive testing and testing

B-2) Mechanical destructive tests: failure localisation - Main experiments and loading conditions

C) Surface analysis: Optical and electronic microscopy - FTIR / ATR - ESCA - SIMS - AFM

D) Surface treatments: Mechanical treatments - Thermal treatments - Chemical treatments - Electromagnetic treatments - Vacuum treatments

BIBLIOGRAPHY

[1] Souheng Wu « Polymer interface and adhesion » Marcel DeKKer editions, New-York, 1982.

[2] J. Israelachvili « Intermolecular & Surface Forces », 2ème édition, Academic press, Londres, 1991

PRE-REQUISITE

GM-3-SIMS-S1 or equivalent