

SPIM-MM-904 Damage mechanics and degradation of materials

Master Degree : Mechanical Engineering and Material sciences Speciality Mechanical and Materials Engineering

Reference number: SPIM-MM-904

Title of the subject : Damage Mechanics and Degradation of Materials

Department : *Applied Mechanics and Mechanical engineering*

Coordinating lecturer : E. Fleury eric.fleury@univ-lorraine.fr, modaressi@univ-metz.fr

Course is given each year

Semester : Autumn

Total hours of classes : 60h ECTS Credits : 4

Teaching language: French or English.

The course is proposed in English for exchange students : Yes

Course composition	Coef.	Number of hours			
		Lectures	Tutorials	Practicals	Others
Fracture, fatigue and damage of materials	0.5	18	12	0	
Surface corrosion	0.5	12	6	12	

Aim :

The topics covered in this class include the concept of brittle and ductile fracture, macro and micro aspects of fatigue, cumulative damage crack initiation and crack growth, application of linear fracture mechanics to failure analysis and fracture controls, environmental effects.

Prerequisites:

Basic knowledge on microstructure of metallic alloys and mechanical behaviour of materials

Course syllabus:

Fracture, fatigue and damage of materials

- Fracture: Griffith's theory of brittle fracture and Gurson model for ductile fracture
- Stress concentration near a notch, stress fields in the vicinity of a crack tip, concept of energy rate release
- Linear fracture mechanics (factor stress intensity, fracture toughness ...)
- Material fatigue, fatigue curves, endurance limit and plastic fatigue, fatigue crack propagation curves
- Mechanical and environmental coupling effect in fatigue

Surface corrosion

Main ideas of aqueous chemistry (redox, acidity-basicity, E-pH diagram)

Types of corrosion: uniform corrosion, galvanic corrosion, intergranular corrosion of stainless steel, pitting corrosion by differential aeration, stress corrosion

Protection against corrosion : protection of metals by anodic passivation, cathodic protection current required or using soluble anode, inhibitor adsorption, oxidizing-passivating inhibitors, inhibitors forming conversion coatings, surface coatings.

Assessment method :

Continuous evaluation is generalized in this Master Degree. Students will obtain information concerning the evaluation at the beginning of each semester.

If not successful, a second exam is planned at the end of the semester so students have a second opportunity to obtain the ECTS credit.

Mark is a composite between evaluation elements, which are listed below. The relative percentage of each item is provided on due time.

The course syllabus, the academic weekly planning and the assessment system may be subject to variation. Modifications are dully announced in advance.