

Metals and ceramics damaging

ECTS	Course (h)
3	18

Mention du master transmettant la fiche UE :	Chimie et Sciences des Matériaux
Composante de gestion de l'UE :	Faculté des Sciences – Département de Chimie
Responsable de l'UE :	C. LE BOURLOT
Statut du responsable :	MCF

REQUIREMENTS

- basic knowledge on material science, tensile curve (analyze of a tensile curve to determine the mechanical properties of a material)
- basic knowledge on metallurgy, crystal plasticity, dislocation theory
- basic knowledge on ceramics
- basic knowledge on photon/mater interaction (Xray radiography, Xray diffraction)

PROGRAMM

- Introduction of material failure: Strength vs. Toughness ; ductile/brittle behavior ; macroscopic tests ; stress intensity factor ; fracture toughness ; Critical crack size
- Void germination, growth, coalescence theories: behavior laws, second phase effects, influence of the triaxality, implementation behavior laws
- Fatigue, cyclic loading: Paris law and propagation, Wöhler curve, Enhancing resistance to fatigue
- Sstatistical approach: cumulative probability of failure, Weibull, impact of initials defects
- Select materials and processes to propose an alternative or innovative solution for a simple mechanical design problem (apply a procedure of material and process selection).
- Macroscopic tests, standards, visualization and identification of fracture surfaces (ductile/brittle)
- Application with Xray Computed Tomography: principal, 3D reconstruction, data post treatment, possibilities and limitations

SKILLS

- understanding the physical origin of fracture for the different classes of materials.
- distinguishing ductile/Brittle behaviors
- using materials selection methods based on material index for performance
- knowing Microstructure-Properties relationship for failure properties on steels, aluminum alloys, ceramics
- undestanding and being able to use Xray Computed Tomography for material science