

# X-ray scattering and diffraction using synchrotron radiation

## Quantitative analysis of the microstructure of polycrystalline materials

The high energy of the X-ray beams allows 3-dimensional probing of polycrystalline materials like ceramics. Heterogeneities at the microscale can be characterized in detail by tomography. Complementing this, X-ray diffraction is a well-known method allowing extraction of both structural and microstructural characteristics at the crystal scale and the quantitative level. After some consideration of the fundamental science involved, the courses will be illustrated by measurements on ceramic oxide materials. Emphasis will be put on in situ measurements at high temperature. Additionally, there will be the rare opportunity to see the application of the science discussed during the course put into action in a visit to the European Synchrotron Radiation Facility (ESRF) in Grenoble.



### Training Schedule, Saturday 1<sup>st</sup> July: Institut National des Sciences Appliquées de Lyon (INSA Lyon)

Morning Session: X-ray diffraction by polycrystalline materials, by Prof. Guinebretière (IRCER, Limoges)		Afternoon Session: Stress analysis using X-ray diffraction, by Dr. Castelnaud (PIMM, Paris)	
08h30 - 10h00	<b>X-ray diffraction from a single crystal to polycrystalline materials</b> - Electron and X-ray photon elastic interaction - Atom scattering, diffraction by an assembly of atoms. The case of a crystal. - 1D to 3D spreading of the diffraction signal into the reciprocal space - From a crystal to a polycrystal	13h30 - 15h00	<b>Stress and strain in crystalline materials</b> - Elastic behaviour of anisotropic crystals - X-ray diffraction of stressed crystals - Multiscale analysis of polycrystal deformation - Intra and inter crystalline stresses heterogeneity in polycrystalline materials
10h00 - 10h30	<b>Coffee break</b>	15h00 - 15h30	<b>Coffee break</b>
10h30 - 12h00	<b>Experimental measurements</b> - Conventional experimental set-up at the laboratory scale - From the laboratory scale to the large-scale facility (synchrotron radiation) - Global versus local measurement at the synchrotron beamlines	15h30 - 17h00	<b>Experimental measurements</b> - Stress analysis using conventional set-up - Global analysis using monochromatic synchrotron beam - Local stress analysis using synchrotron radiation
12h00 - 13h30	<b>Lunch</b>		

### Site visit, Friday 7<sup>th</sup> July: European Synchrotron Radiation Facility (ESRF), Grenoble

- Optional for the participants of the course,
- Transport will be organised to and from the site, free of charge,
- Exact times to be confirmed