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Interest of radiolysis tools within the EMIR network

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Radiation chemistry (or radiolysis) deals with the chemical reactions resulting from the interaction of high-energy photons or particles with matter. Such radiation possesses an energy that is high enough to induce ionisation of the components of the material and to lead to the cleavage and formation of chemical bonds.

Usually applied to liquids on multiple timescales, it can also provide precious information on solids (oxides, polymers....) or on processes taking place at interfaces.

In this presentation, I will show different radiolysis set-ups that can be of interest for the EMIR community:

- i) ALIENOR, a 10 MeV electron accelerator with a nanosecond time resolution, available at NIMBE (CEA/Saclay). This LINAC allows for instance studying gases released during irradiation of oxides, polymers, heterogeneous materials....
- ii) ACCIR, a compact 60 keV electron gun coupled to an infrared detection (NIMBE, CEA/Saclay). This platform enables detecting *in situ* the effect of accelerated electrons on thin films by means of infrared spectroscopy.
- iii) ELYSE, a fast kinetics center (Université de Paris Sud). ELYSE's 4 to 9 MeV accelerator ultrafast pump-probe facility at Orsay can initiate reactions using both ultrashort electron pulses (picosecond pulse radiolysis) or photon pulses (photolysis) to produce different reactive species for the observation of reaction pathways. Kinetics can be measured on a wide range of wavelengths (from the UV to the near infrared) and on timescales ranging from picoseconds to one millisecond.
- iv) ARRONAX is a cyclotron located in Saint Herblain. It is complementary to the CEMHTI facility in terms of energy range and LET values. It provides for instance helium ions that can be used to study corrosion mechanisms induced by alpha radiolysis, or gases released upon alpha irradiation of various solids, among other applications.

In each case, I will illustrate the possibility of the corresponding facility with some examples of interest in the field of solids and polymers.