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 2017 - 2020  
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# Evaluation of viscoelastic properties and the damage of polyethylene subjected to oligo-cyclic loading in relation to their microstructures.

Equipes (PVMH)

## Context

### Polyethylene:

- High ductility and good resistance to shocks and seism
- Classical and typical semi-crystalline polymer

### Oligo-cyclic loading:

- modeling of the seismic wave
- Imposed strain reaches the plastic range

### Aim :

→ To evaluate the influence of the oligocyclic loading on the microstructural properties and the mechanical properties of the polyethylenes

## Method and tools

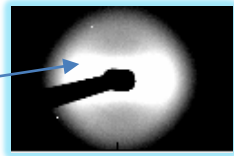
### Characterization on macroscale:

- **Tensile test** : Elastic modulus, yield stress, necking, toughness
- **DMA** : storage modulus  $E'$ , loss modulus  $E''$ , relaxation  $\alpha, \beta$
- **Oligocyclic tensile test**: hysteresis loop, evolution of modulus
- **DSC** : evaluate the crystallinity

### Characterization on microscale:

- In-situ SAXS measurements (synchrotron SOLEIL): local deformation of spherulite, evolution of crystalline lamellae, evolution of cavitation.

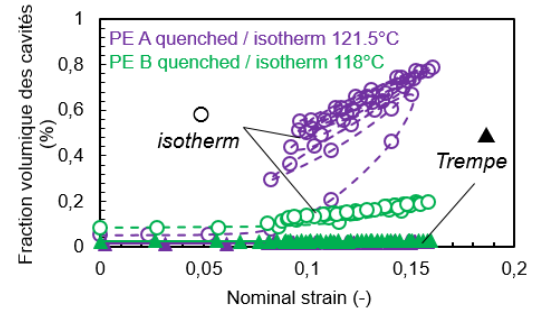
X-ray scattered by cavities



- In-situ AFM: direct observation of evolution of morphology and microstructure.

## Results

- Time-dependent evolution of cavities (reversibility) during the oligo-cyclic tests and its dependency on microstructural properties:



- Evolution of elastic modulus during mixed mode oligo-cyclic tests and its dependency on microstructure: