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Probing structure development during "in-operando" processes by time resolved simultaneous Small and Wide Angle X-ray Scattering with synchrotron radiation

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Since the earliest application of synchrotron radiation to the investigation of soft condensed matter it became clear that time resolved Small Angle X-ray Scattering (SAXS) experiments enabled plenty of opportunities for precise "in-situ"structural characterization[1-3]. The simultaneous use of Wide Angle X-ray Scattering with SAXS (SAXS/WAXS) paved the way for an extensive plethora of experiments aimed to characterize "in-situ"and "in operando"a great variety of processes in which structural changes take place. Nowadays there are a great variety of processes for which the monitoring of the structural modifications occurring while operation can be of great interest in order to optimize the process. As an example battery performance or additive manufacturing (AM) are among the novel topics in which "in-situ"and "in-operando"studies can be significant[4, 5]. In spite of the effort done in this respect there is still room for further developments aiming to provide user friendly platforms mimicking as close as possible everyday life processing conditions. In this talk, different approaches and the corresponding methodology for performing simultaneous SAXS/WAXS with synchrotron radiation during "in-operando"3D printing of polymers will be presented. In particular Fused Filament Fabrication (FFF) is one AM method based on the continuous layer-by-layer deposition of a polymer molten jet produced by hot extrusion. Upon deposition, the polymer melt cools down and solidifies out of equilibrium. The crystallization conditions of the polymer jet have a direct impact on the mechanical performance of the fabricated piece. The results will be compared with other crystallization experiments in noble gases liquid jets[6]. It will be emphasized the importance for "in-situ"and "in-operando"time resolved experiments of an up- grade in NCD-SWEET beamline at ALBA aiming for larger area detectors for both SAXS and WAXS stations to improve the time resolution below 100 ms as well as developments for treatment of big data.

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