ESRF	**Experiment title:** Mimicking the Selective Sintering Process of micron sized Polymer Particles using Nanofocus X-ray Diffraction	**Experiment number**: MA-1596
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Report:

DuraForm® PA12 is one of the most used polymer powders for selective sintering. The structural changes during sintering of micron-sized particles were studied by nanofocus X-ray scaterring. An original home-made chip heating accessory based on existing commercial semiconductor sensors was implemented on the ID13 beamline. PA12 particles were deposited on the heating membrane in contact with each other (cf. Fig 1, left) and the sensor was placed in a way to allow performing X-ray diffraction measurements in transmission geometry.

The region of interest (ROI) located at the border between the particles was scanned with a nanosized X-ray beam with high lateral resolution (cf. Fig 1, right). In the example shown here the total scanned area was 10x10 μm^2 with a step size of 500nm. Information corresponding to changes in heat capacity and temperature of the particles was provided by the Nanocalorimetric measurements during heating.

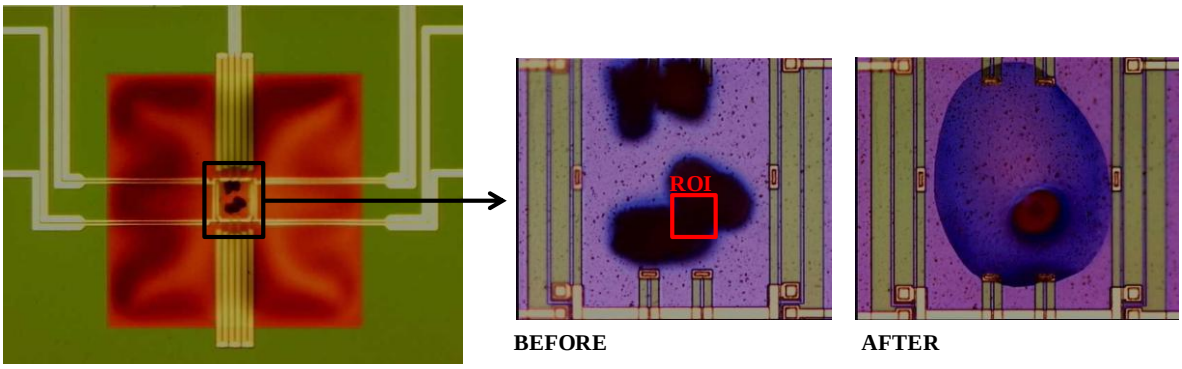

Figure 1. Image of the chip of the home-built Nanocalorimeter loaded with single PA particles (left). Enlarged images of the active area of the chips before and after the sintering process (right). Red square indicates the ROI scanned.

Figure 2 shows the SAXS data obtained during a 2D scan in the ROI corresponding to the border between the PA particles. The SAXS data is zoomed as to leave visible only the main interference maximum, making it similat to vector field patterns. The regions where changes of the vector direction are noticeable are supposed to correspond to transitions between local zones having different crystalline features (either different particles, or the boundary between native and recrystallized regions).

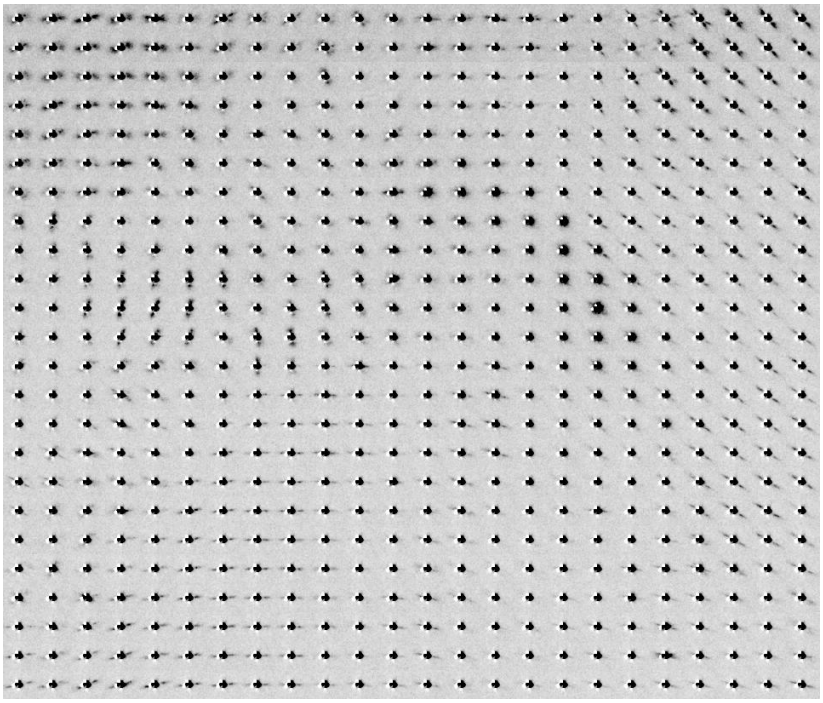

Figure 2. SAXS "vector field" patterns obtained during 2D mesh scan performed in the interparticular region shown in Figure 1.

The results obtained during these measurements indicate that coupling of Nanocalorimetry with synchrotron micro-focus X-ray scattering would be useful in order to establish correlations between the processing conditions and final microstructures of fused particles, opening the path for studies of the interfacial chain dynamics and crystallization mechanisms that mimick the real processing conditions.