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Nanoparticle twinning observed using correlated x-ray scattering at a free electron laser DEREK MENDEZ, HERSCHEL WATKINS, Stanford Univ, DANIEL RATNER, Stanford Linear Accelrator Center, GUNDOLF SCHENK, SEBASTIAN DONIACH, Stanford Univ, DONIACH GROUP TEAM —

Correlated x-ray scattering (CXS) is a novel technique that aims to extract highly detailed information from many exposures of a solution of particles (e.g. nanoparticles (NPs)). During each exposure, a small fraction of all particles are oriented such that they may scatter into spatially separated pixels on an area detector. When this happens, there is a positive correlation between these pixels. In Powder-XRD, one averages over the azimuth to get the mean intensity into a scattering vector magnitude, however azimuthal information is lost. Consider the (111) family of scattering planes in gold NPs. Occasionally two sets of (111) planes scatter photons into the detector, and a positive correlation will appear at an angle which corresponds to the angle between (111) crystal planes. It is well known that FCC NPs will form twinned structures, in which multiple FCC domains are joined yet rotated relative to one another. With CXS we can resolve this twinning signal and determine the average twinning structure of NPs in solution, a result which cannot be obtained with conventional Powder-XRD.

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