

Probing dynamic materials under extreme conditions using combined in situ X-ray diagnostics

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Dynamic shock compression of materials can induce exotic phase transitions and chemical reactions resulting in new material structures that may be interesting for applications if successful recovery to ambient conditions is possible. Specific examples include nanodiamonds formed by dynamic compression of plastics and hexagonal diamond, which is predicted to exceed the hardness of its cubic polymorph, and can form via fast uniaxial compression of highly oriented graphite. New methods of in situ diagnostics at XFEL and synchrotron light sources allow for capturing the multiscale nature of these processes in unprecedented detail. This talk will discuss the state-of-the-art and future developments for measurements of dynamically compressed carbon and plastics applying in situ X-ray diffraction, small angle X-ray scattering and inelastic X-ray scattering as well as optical diagnostics in a single experiment. These methods will further benefit from the increase in repetition rate enabled by the HIBEF drive laser installation at European XFEL.

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