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Time resolved diffraction of SHS reactions at the HED instrument at European XFEL

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Self-propagating high-temperature synthesis (SHS) allows the synthesis of a large variety of compounds and new materials in an energy-efficient way. They have therefore been extensively studied and are well characterized with respect to the equilibrium thermodynamics.

In contrast, the characterization of the transient processes before, in, and after the reaction fronts have not been characterized yet due to the extreme reaction rates (propagating with 1 –150 mm/s), temperatures (up to 4 500 K) and heating rates (between 1 000 and 100 000 K/s).

In a project funded by BMBF, our goal is to contribute to the infrastructure for time resolved diffraction experiments in the femtosecond region including an appropriately fast radiometric pyrometry at the High Energy Density Science (HED) instrument at European XFEL. The SHS experiments will be carried out in a small chamber located in the interaction area 2. For the temperature determination, a fast pyrometer built by the HED group of GSI has been adopted.

First experiments during commissioning of the instrument will include the formation of silicides, and will focus on structural changes before, in, and after the reaction front. We expect first beam in the beginning of 2019.

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