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High Brightness Self-Seeded X-Ray FEL and Its Applications at PAL-XFEL

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Nearly fully coherent hard X-ray self-seeded (HXRSS) free-electron laser (FEL) pulses with an unprecedented peak-brightness and a narrow spectrum using the forward Bragg-diffraction (FBD) monochromator has been provided. We have achieved outstanding performance of HXRSS FEL over photon energy range covering from 3.5 keV to 14.6 keV at PAL-XFEL. Furthermore, an averaged energy of seed FEL of ˜1mJ is obtained in the range from 5 keV to 10 keV. With these pulses single-shot coherent imaging (SSI) experiment and serial femtosecond crystallography (SFX) were performed. We developed x-ray energy scanning program with the help of double crystal monochromator (DCM), which results in improved spectral impurity and fully calibrated energy scale. With this energy scanning program, we have conducted test experiments such as resonant inelastic X-ray scattering (RIXS) and X-ray emission spectroscopy (XES), femtosecond time resolved X-ray absorption near edge structure (TR-XANES). In this presentation, we present recent experimental results by using the hard X-ray self-seeded FEL with energy scanning at PAL-XFEL.

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