

## Fixed target system for biological research at PAL-XFEL

Serial Femtosecond Crystallography (SFX) offers several advantages in protein structure analysis, such as the ability to conduct experiments at room temperature with minimized radiation damage. However, SFX experiments using LCP (Lipidic Cubic Phase) suffer from stability issues in chemical reaction with carrier matrix and/or sample flow control. Recently, to overcome these problems, the fixed target technique based on raster scanning has been developed and utilized. In addition to avoiding liquid flow control and related laborious sample preparation process, this technique allows to determine protein structures with similar sample quantity for LCP injection technique under relatively simple sample treatment process. We have developed a unique 2D fixed target chip to perform SFX experiments[1]. The sample chip consists of a nylon mesh, thin polyimide films and metal frames. Micro-crystals are distributed on the nylon mesh that significantly reduce falling of crystals on the chip due to gravity. The thin polyimide films are attached both sides of the mesh to keep the fully hydrated condition. In addition, we have applied metal frames to hold the sample chip instead of plastic one to increase the efficiency during the successive chip exchanges. The material of the metal is magnetic 304 stainless steel. The 2-dimensional chip positions are controlled with the combination of SmarAct piezo-stages. The amount of required sample to prepare single chip is about 60  $\mu\text{l}$  and the number of collectable images is about 130,000 at 50  $\mu\text{m}$  step over 18 mm ranges, which will be sufficient data for determining a protein structure with single chip. I will introduce the novel 2D fixed target system including its structure and related operational features at PAL-XFEL in detail.

[1] D. Lee *et al.*, *Sci. Rep.* **9**, 6971 (2019)

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