Novel Undulators Developed in SINAP

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A large number of insertion devices are used in the third generation synchrotron radiation facility to produce the high brightness synchrotron radiation light. Since five insertion devices were finished in the Phase-I project of SSRF (Shanghai Synchrotron Radiation Facility) in 2009, seventeen insertion devices have been developed in Shanghai Institute of Applied Physics (SINAP), including eight short period length in-vacuum undulators (IVUs), three elliptical polarization undulators (EPUs), one double EPU and one in-vacuum wiggler for SSRF and other synchrotron radiation facilities such as PLS, HLS and CLS. About 200 advanced undulators are in building or will be built in next several years for SSRF Phase-II and XFEL facilities developing in SINAP.

An exotic undulator, the APPLE-Knot undulator which can reduce the radiation power on-axis and restraint the higher harmonic radiation effectively was built in 2015. The undulator consists of four inner quasi-periodic APPLE-II magnet arrays and four outer additional magnet arrays. The lowest photon energy of the different polarized radiations is 7eV.

Based on the technology of the in-vacuum undulator, two cryogenic permanent magnet undulators (CPMUs) are developed in SSRF in last two years. CPMU20 which has the period length of 20mm and the period number of 80 uses the NdFeB magnets and the effective peak field of 1.02T can be obtained at the gap of 6mm. CPMU18 with the period length of 18mm and 144 periods uses the PrFeB magnets and can provide the effective peak field of 0.91T at the gap of 6mm.

In this report, two kinds of novel undulators, one APPLE-Knot undulator and two cryogenic permanent magnet undulators developed at SSRF are introduced, including their magnetic performance and some operational results. Other two advanced undulators being built for Shanghai hard X-ray FEL facility SCLF are also described briefly.