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Generation of Intense Pulsed X-ray and Repetitive Pulsed X-rays

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Both intense pulsed X-ray and repetitive pulsed X-rays play an important role in the investigation of various physical processes in hydrodynamic experiments.

In order to generate intense pulsed X-ray, 1.2 MV pulsed power generator and rod-pinch diode are designed and constructed at Institute of Fluid Physics, CAEP. The generator is composed of a Marx generator, an upstream oil line, a pulse forming line, an oil switch, a transfer line and a load. As the working ratio is kept at 70%, the jitter of Marx generator is less than 6 ns, the jitter of the pulsed power generator is less than 18 ns when a copper-sulphate resistive load was used. The X-ray dose of 1.4 R at 1 m in the forward direction and the spot size of 1.47 mm are achieved.

In order to generate repetitive pulsed X-rays, a stacked Blumlein line (SBL) type pulsed power source (220 kV, 1 kA, 1 kHz) based on high power photoconductive semiconductor switches (PCSSs) and industrial cold cathode diode have been constructed at Institute of Fluid Physics, CAEP. Metal-ceramic surface flashover cathodes (spoke-shaped or not) are employed to enhance electron emission and improve the diode performance. ICCD images show that the spoke-shaped metal-ceramic surface flashover cathode has more uniform electron emission than metal foil cathode. Repetitive pulsed X-rays with dose of 25 mR, FWHM of 40 ns and repetition rate of 1 kHz were generated.

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