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Repetitive pulse X-rays generator based on all solid state pulsed power source

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Repetitive pulse X-rays play an important role in the investigation of various physical processes in hydrodynamic experiments. Generation of repetitive pulse X-rays requires repetitively operating all solid state pulsed power source and X-ray diode.

As the testbed for repetitively operated diodes, a stacked Blumlein line (SBL) type pulsed power source (220 kV, 1 kA, 1 kHz) based on high power photoconductive semiconductor switches (PCSSs) has been constructed at Institute of Fluid Physics, CAEP. The industrial cold cathode diode was employed to generate intense X-rays.

The blade-shaped metals or metal foils are typically used as the cathode material. In order to enhance electron emission, metal-ceramic surface flashover cathodes (spoke-shaped or not) were proposed and tested recently. The electric field strengths at triple points were calculated and used to determine the cathode parameters. ICCD images show that the spoke-shaped metal-ceramic surface flashover cathode has more uniform electron emission than metal foil cathode. The experimental results show that metal-ceramic surface flashover cathode could improve the diode performance by enhancing emission current. By employing spoke-shaped metal-ceramic surface flashover cathodes, pulse X-rays with FWHM of 40 ns were generated. This all solid state X-ray generator can be operated in the repetition rate more than 1 kHz.

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Primary author: YUAN, Jianqiang (China Academy of Engineering Physics)

Co-authors: Prof. LI, Hongtao (Institute of Fluid Physics, China Academy of Engineering Physics); Mr LIU, Hongwei (Institute of Fluid Physics, China Academy of Engineering Physics); Mr WANG, Lingyun (Institute of Fluid Physics, China Academy of Engineering Physics); Mrs JIANG, Ping (Institute of Fluid Physics, China Academy of Engineering Physics); Prof. XIE, Weiping (Institute of Fluid Physics, China Academy of Engineering Physics); Dr MA, Xun (Institute of Fluid Physics, China Academy of Engineering Physics)

Presenter: YUAN, Jianqiang (China Academy of Engineering Physics)

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