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Research on 24MJ PFN for electromagnetic launch discharged in sequence

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ABSTRACT: Electromagnetic launch technology(EML) is a prime candidate for furture long range artillery systems. Pulse thyristor is one of the key components in pulse power supply(PPS). Mutiple modules are fired sequentially to generate flattop waveform for the load. However, in the circumstance, thyristors are easy to fail. In this paper, the pulse thyristors'reliability was researched when the pulse forming network(PFN) was fired sequentially. The reverse recovery over voltage in discharge process is the main reason of thyristors' failure. Based on a 24MJ Electromagnetic launch system, a macro-model of scr was eatablished, in which, the reverse recovery process was taken in consideration. The change of reverse recovery over voltage was fitted by hyperbolic secant function. Experiments showed that the model could precisely predict reverse recovery over voltage of pulse thyristors in the 24MJ Electromagnetic launch system. On the other hand, this paper studied the inhibition of inductance on the reverse recovery over voltage of scr in PPS. It was showed through simulation that an appropriate increase of induntance value could effectively inhibit current drop rate so as to inhibit the reverse recovery over voltage of scr. Meanwhile, the overall efficiency of PPS would not decline significantly. This paper took 24MJ Electromagnetic launch system as test platform. In the first round of testing, 13 pulse forming units(PFU) was fired sequentially. The thyraitors failed when the inductance value was 10uH. Then, 120 inductor was added to each PFU through converting parameters. After that, The 24MJ Electromagnetic launch system operated reliablely when it was triggered in different time sequence.

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