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We have been developing an inductive pulsed power supply (PS) consisting of several superconducting pulsed power transformers with Marx generator methodology. Each of these pulsed power transformers consists of a copper secondary winding and a high-temperature superconducting primary winding. In order to obtain a high-voltage impulse, the Marx generator should be charged via the parallel connection of capacitors and discharged via a series connection. In contrast, this superconducting pulsed PS is excited in series connection of superconducting primary windings and discharged in the parallel connection to obtain a large pulsed electric current. Our preliminary experiment result showed that the process of one transformer module was correct. In this paper, the characteristics and simulation results of the superconducting inductive pulsed PS are described.

This paper appears in: [Applied Superconductivity](#), IEEE Transactions on, Issue Date: Oct. 2012, Written by: Haitao Li; Yu Wang; Weirong Chen; Wenbo Luo; Zhongming Yan; Liang Wang

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INDUCTIVE storage for pulsed power supplies is considered to have a greater potential for energy density than a capacitor, making an inductive pulsed power supply (PS) attractive than capacitor-based one in some applications (e.g., electromagnetic launchers) that need current pulse. A major obstacle in designing inductive pulsed power supplies is developing an opening switch to commutate the large electric current [1]. On this issue, three circuit structures are considered. The first one is to reduce the storage current by increasing the coil numbers without altering the magnitude of the output current. This circuit structure generates the current pulse by applying the methodology of the Marx generator. It has been demonstrated by parallel operation of normal conducting storage inductors and superconducting storage inductors [2], [3], [4]. However, using this method to achieve high-level current amplitude requires a lot of coils, and that will make the system more complex. The second one is to use a pulsed power transformer, which is often used as energy compression devices in many applications. When energy transfer is required, a rapid current collapse in the primary winding is excited, and a large level of current is induced in the secondary winding. In this case, another problem occurs, i.e., the load voltage on the secondary side moves to the primary side with multiplied voltage by the winding ratio of the transformer, and as a result, it becomes difficult to open the circuit [4]. The last one is an inductive-capacitive hybrid meat grinder circuit, which reduces the voltage requirement of the opening switch and increases the amount of energy transferred to the load [5].

To combine the three circuit features aforementioned, a new inductive pulsed PS consisting

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Haitao Li, Yu Wang, Weirong Chen, Wenbo Luo, Zhongming Yan, and Liang Wang

**Abstract**—We have been developing an inductive pulsed power supply (PS) consisting of several superconducting pulsed power transformers with Marx generator methodology. Each of these pulsed power transformers consists of a copper secondary winding and a high-temperature superconducting primary winding. In order to obtain a high-voltage impulse, the Marx generator should be charged via the parallel connection of capacitors and discharged

When energy transfer is required, a rapid current collapse in the primary winding is excited, and a large level of current is induced in the secondary winding. In this case, another problem occurs, i.e., the load voltage on the secondary side moves to the primary side with multiplied voltage by the winding ratio of the transformer, and as a result, it becomes difficult to open the





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