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M3Or2G-02: [Invited] Ultrafast, Ultracompact Superconducting Series-Type Hybrid Circuit Breaker (SS-HCB)

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Energy to Power Solutions (e2P) in collaboration with the Illinois Institute of Technology (IIT) is developing a new Superconducting Series-type Hybrid Circuit Breaker (SS-HCB) concept for dc fault protection. The Ss-HCB is fundamentally different from other prior-art hybrid circuit breakers (HCB) or solid-state circuit breakers (SSCB) in the literature. The SS-HCB conducts its primary load current through High Temperature Superconducting (HTS) wires instead of power semiconductor switches and curtails its fault current to near zero

throughout the entire opening process of a series mechanical switch. It offers the low ON-resistance of the conventional mechanical contacts for normal operation and μs -scale fault response, even faster than the fast-acting SSCBs. A proof-of-concept SS-HCB prototype experimentally demonstrates the interruption of a fault current of 30 A within 10 μs at a dc voltage of up to 5000 V. The operating principle, simulation, and experimental results are discussed in this paper.

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