

# **A 100KV SWITCH MODE SERIES RESONANT POWER SUPPLY FOR INDUSTRIAL ELECTROSTATIC PRECIPITATORS**

F. Carastro <sup>1)</sup>, J. C. Clare <sup>1)</sup>, A. Goodman <sup>1)</sup>, P. W. Wheeler <sup>1)</sup>, J. Leach <sup>2)</sup> and T. Hosking <sup>3)</sup>

*1) University of Nottingham, Nottingham, NG7 2RD, United Kingdom*

*2) Castlet Ltd, Lincoln, LN3 4NR, United Kingdom*

*3) SBE, Inc., Barre, Vermont, 05641-4854, USA*

*E-mail: fabio.carastro@nottingham.ac.uk*

High power electrostatic precipitators (EPS) are used to remove dust particles to reduce the emissions of a variety of sites. These include gas and oil fired power stations, cement and steel production facilities and waste incinerator plants. This market is growing due to increasingly stringent emissions targets across the world. For most precipitators, a power supply with a high voltage output of 50kV to 100kV with high short-circuit capability is required to achieve the best efficiency of dust removal. Traditional power supplies in use for high voltage EPS systems are based upon 50/60Hz, line frequency technology which demands large transformers to step up the voltage. The dc output voltage is generally controlled with power electronic switches placed at the low voltage side. The large growth of existing applications for modern high voltage EPS systems has pushed the search for novel power supply configurations with reduced size, high efficiency and fast transient response to control the output voltage during sparking.

Resonant converter technology is now being considered to meet these power supply needs. Resonant converters are becoming more widely used in industrial processing systems because of their soft-switching characteristics at high frequencies. The main advantage of high-frequency operation is the smaller size and lighter weight of the passive components used, compared to conventional power supplies. This paper considers the design of a switch mode series resonant series-loaded power supply rated at 100kV, 2A for high voltage EPS applications. The supply is based on an H-bridge single-phase resonant power supply, fed by a rectifier. The 100kV dc voltage output is obtained by combining a 1:47 ferrite core transformer with a two stage Cockcroft-Walton voltage multiplier. A PI controller is designed to control the resonant tank current hence the output voltage of the precipitator, allowing improved performance especially during short-circuit output conditions. Combined frequency and phase control is also used to maintain soft-switching in all IGBTs, thus minimizing the semiconductor losses. The paper presents an overview of the technology and the design of the test rig prototype under study. Simulation and experimental results will be provided to identify effectiveness and limitations of the technology used.