

**APPLICATION OF PULSED SPARK DISCHARGE
FOR PRECIPITATION OF CALCIUM CARBONATE
AND PREVENTION OF MINERAL FOULING IN
HEAT EXCHANGERS***

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One of the challenges in the production of electricity is the cooling water management because the calcium content in circulating cooling water continues to increase with time as pure water evaporates. Thus, the excessive mineral contents in water circulation systems could cause severe fouling in heat transfer equipment. To avoid the catastrophic failure in condensers, the cooling water is discharged after 3 cycles at a rate of 10 million gallons a day in a 1,000-MW thermoelectric power plant. The objective of the present study was to investigate the feasibility of using plasma discharge in water to precipitate excess calcium for the prevention of mineral fouling in condensers. The plasma discharge used in the present study utilized microsecond duration pulse spark discharge in water with a voltage up to 30,000 V and a typical peak-peak current of 100 A.

Precipitation tests were conducted using spark discharges in water with calcium carbonate hardness ranging from 200 to 400 ppm, demonstrating that the plasma discharges could reduce calcium ion concentration in cooling water by 20-25% with energy input of about 4000 J/L. Furthermore, mineral fouling experiments were carried out in a concentric counterflow heat exchanger with a spark discharge system. The fouling resistance was observed to decrease by 60-70% for the plasma treatment case compared with that for the no treatment case, indicating that the plasma discharge could be used as an energy-efficient green technology for the mitigation of the mineral fouling in heat exchangers in a cooling loop.