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Plasma-based Water Treatment: Opportunities and Challenges

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Electrical discharges within and in contact with water produce various reactive species. Despite competitively high concentrations of oxidative OH radicals and reductive solvated electrons formed, plasma-based water treatment has not yet reached a level of development where it can be commercially used. We have found that the performance of plasma reactors used for water treatment depends on multiple factors including the area of the plasma in contact with water, the discharge phase, bulk liquid mass transport, and the type of the compound treated. This work will present two plasma reactors that integrate these design parameters: 1) an enhanced contact plasma reactor for the degradation of surface-active compounds that has been installed into a mobile trailer and demonstrated for the treatment of groundwater and 2) a spinning disc plasma reactor which has been used to treat non-surfactants. The performance of these plasma reactors will be correlated with the fundamental processes occurring at the plasma-liquid interface and in the bulk liquid. Recommendations for plasma reactor scale-up and opportunities in different water treatment market segments will also be given and discussed.