LIFETIME AND DESIGN CONSIDERATIONS FOR ANODES FOR PULSED UNDERWATER CORONA DISCHARGES*

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Efficient decontamination of wastewater by pulsed underwater corona discharges was demonstrated in many studies [1,2]. Recently, the streamer density and length, the major factors determining decontamination performance, could be increased by using Titan anodes which previously were coated with an Almandine ceramic. However, the expensive and sophisticated ceramic coating and the short lifetime, of about 10^5 pulses make this technique inefficient for industrial application.

Metal wires, with a diameter smaller than 300 µm, provide a cheaper anode alternative. These anodes could be continuously replaced to avoid ruptures during operation by using a withdrawable unit. Based on these constructive ideas, the length and density of streamers, generated by various metal wires with different diameters and configurations, were investigated by means of image processing.

The analyses of the anode surface by electron microscopy has shown, that the high temperature generated in the streamer leads to local melting of the anode surface. Also because of the high melting point of tungsten (3422 °C), tungsten wires with diameters between 100 and 300 µm turned out to be suitable for anode use. Anodes metals with melting points lower than the streamer temperature (>3400 °C) would erode faster. The analysis of images of the underwater corona discharges proved that for all types of anodes the length of streamers lineary increased with anode voltage and was almost independent of the type of anode. The water volume interspersed by streamers, normalized to the total treatment volume was significantly higher when applying Ti-Almandine anodes. However, the efficiency of corona discharges to decontaminate *Enterococcus f.* bacteria in wastewater was similar for all anode types.

1. M. Sato, T. Ohgiyama, and J. S. Clements, "Formation of chemical species and their effects on microorganisms using pulsed high-voltage discharges in water", IEEE Trans. Ind. Appl., 1996, pp. 106-112.
2. A.-A. Ghazala, S. Katsuki, K. H. Schoenbach, and K. R. Moreira, "Bacterial decontamination of water by means of pulsed-corona discharges", IEEE Trans. Plasma Sci., 2002, 2003, pp. 1449-1453.

* Work supported by BMBF 02WT0675