

Electrochemical Destruction of Perfluorooctanesulfonate in Electroplating Wastewaters

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Summary

Our labs are now at 100% capacity, laboratory work this quarter continued to focus on the development of a tubular reactor to test PFAS oxidation. Work was specifically focused on overcoming challenges related to current collector corrosion. It was found that plugging the pores on the ends of the membrane using a sol-gel method and utilizing niobium as a current collector overcame problems with corrosion.

Current Collector

During the course of long-term PFAS oxidation experiments (> 8 hours), it was found that the stainless-steel current collector that was used to make electrical contact with the porous reactive electrochemical membrane (REM) began to release iron into solution. Since the electrode is porous, the current collector was in direct contact with the electrolyte as it permeated through the pores. In order to overcome the corrosion of the current collector, two strategies were utilized. First, different metals were investigated as suitable current collectors. Second, the pores on the edge of the REM were sealed in order to provide an area for connection of the current collector where the electrolyte was not present. For the first task, we tested several metals (e.g., Au-plated stainless steel, Ti, Nb, and Ta). It was found that both Nb and Ta were the most resistant to corrosion, and ultimately Nb was chosen because it is cheaper than Ta.

The second task (*i.e.*, sealing the pores) was accomplished by using a sol-gel method. Sealing of the pores was accomplished using a dip coating procedure, that is shown schematically in Figure 1. The Ti_4O_7 REM was dip coated in a titanium isopropoxide sol gel solution. The sol was allowed to hydrolyze at room temperature and then sintered/reduced at $900^\circ C$ in flowing H_2 . The hydrolysis step allowed for the growth of the TiO_2 coating, and the

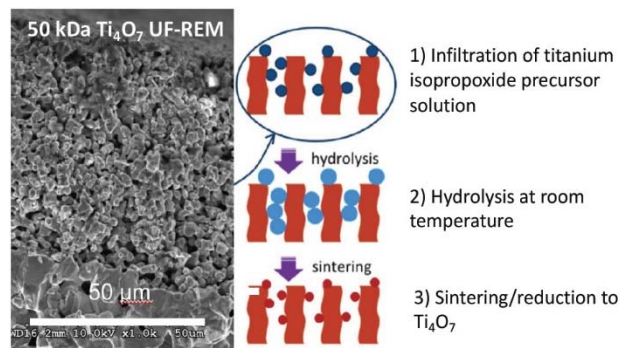


Figure 1 - Procedure for dealing REM pores.

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heat treatment provided adhesion and reduction of the TiO_2 coating to Ti_4O_7 . The procedure shown in Figure 1 was repeated for three cycles in order to completely seal the pore.

About the author



Dr. Brian P. Chaplin is Associate Professor in the Department of Chemical Engineering, at the University of Illinois at Chicago. He holds a B. Civil Engineering (1999) and an M.S. (2003) in Civil Engineering from the University of Minnesota and a Ph.D. in Environmental Engineering (2007) from the University of Illinois at Urbana-Champaign.