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SEM AND EDS CHARACTERIZATION OF TITANIUM CATHODES BEFORE AND AFTER ELECTROLYSIS IN HEAVY WATER

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A series of experiments were conducted with titanium cathodes and platinum anodes electrolyzed in heavy water-sulfuric acid electrolyte in closed cells. Each of the cathodes in these experiments was cut from the same titanium foil (99.99% Ti). Each cathode underwent a pre-experiment and a post-experiment SEM (ISI-SS40) and EDS (LINK AN10000) analysis. Of the eight experimental cathodes, three showed post-experimental evidence of localized chemical changes.[1] This is consistent with other findings from this lab.[2,3] Results obtained on one of these cathodes are presented here.

This cathode was electrolyzed for 115 hours at 0.40A (current density about 2A/cm^2). The cathode was ultrasonically cleaned in deionized water for five minutes prior to the pre-experiment analysis. Fig. 1 shows the smooth surface of the cathode before electrolysis. No other elements besides titanium were found. After electrolysis in 19.4g D_2O+ 1.0g H_2SO_4 the cathode was removed from the cell and rinsed by gentle agitation in deionized water for several minutes. It was then examined in the SEM, where changes in the surface topography were observed as shown in Fig. 2. Fig. 3 shows that the original smooth surface has become rough and has a network of cracks. The spectrum from area two is shown in Fig. 5. In addition to Ti, characteristic peaks for S, K, Cr (or V) and Fe are present. Sulfur is present in the electrolyte, but K, V, Cr and Fe are not expected to be present in appreciable concentrations in the electrodes or the electrolyte. Leaching of these elements from the glass container by the weakly acidic electrolyte is expected to be minimal.

The cathode was then cleaned ultrasonically in deionized water and re-examined in the SEM. Fig. 4 shows an enlargement of area A in Fig. 3, and Fig. 6 gives the EDS spectrum from spot 1. Again S, K, Cr (or V) and Fe are present. Spot 2 (Fig. 4) serves as the background check, showing only titanium.

The SEM and EDS data from the three altered cathodes combined with the calorimetric data from the same cells not covered here suggests some type of new reaction at the nuclear level has taken place. Several other labs have found evidence for the same type of nuclear phenomena.

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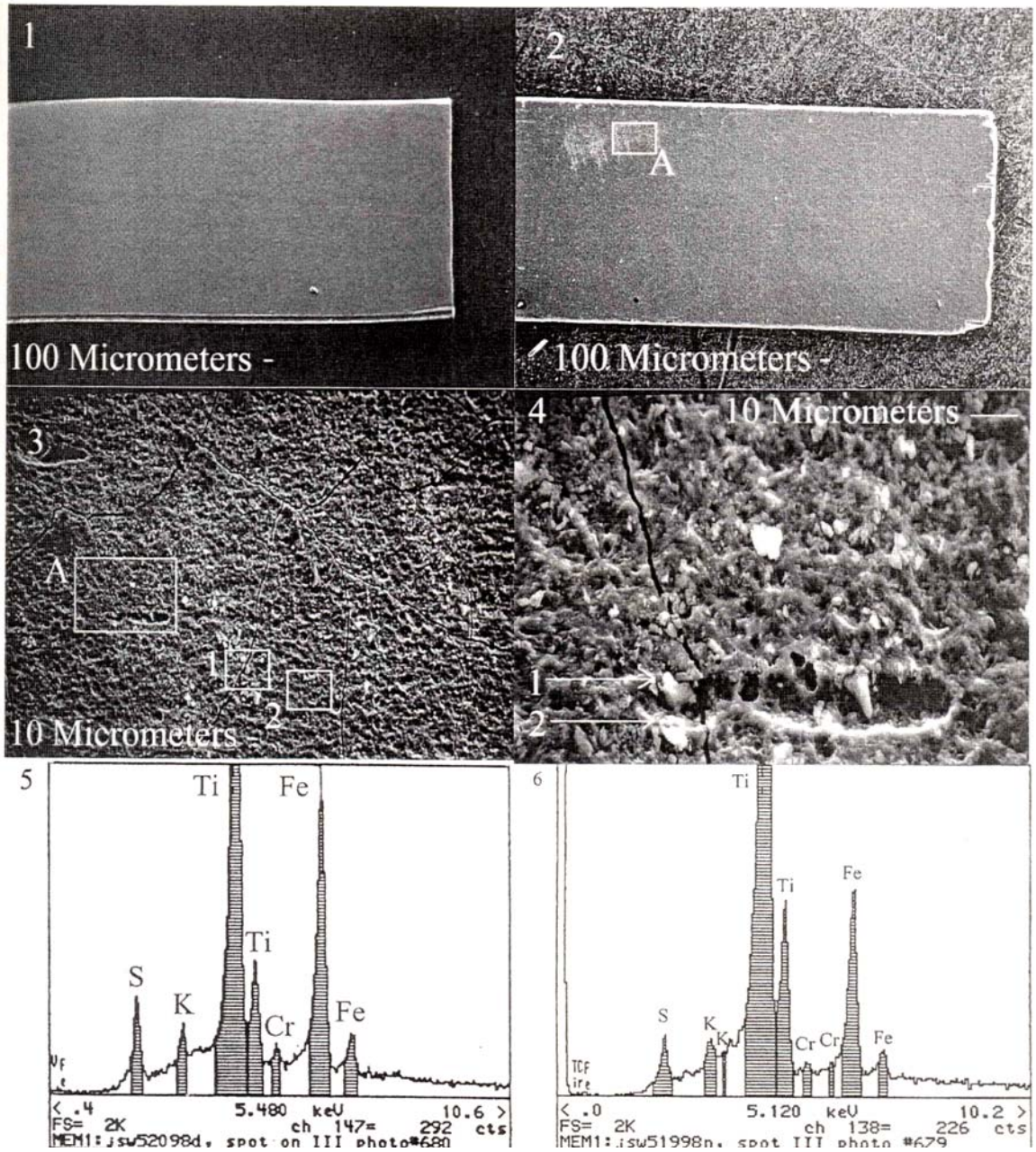

Figure 1: Pre-experiment photo of experimental Ti cathode.
Figure 2: Post-experiment photo of experimental Ti cathode.
Figure 3: Area A of Fig. 2. Ti cathode after electrolysis and rinsing in deionized water.
Figure 4: Area A of Fig. 3. Ti cathode after ultrasonic cleaning in deionized H_2O.
Figure 5: EDS of area 1, Fig. 3, showing unexpected elements. Area 2 contains only Ti.
Figure 6: EDS of spot 1, Fig. 4, containing unexpected elements. Spot 2 contains only Ti.