

Improvement on Szpak Cell

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given so as to see the relative distances involved, however.

Fig. 2 shows the conceptual basis for the above remarks. It shows the Szpak's cell with all but the copper foils and Pd layer removed. It also shows expected electrostatic field intensity lines.

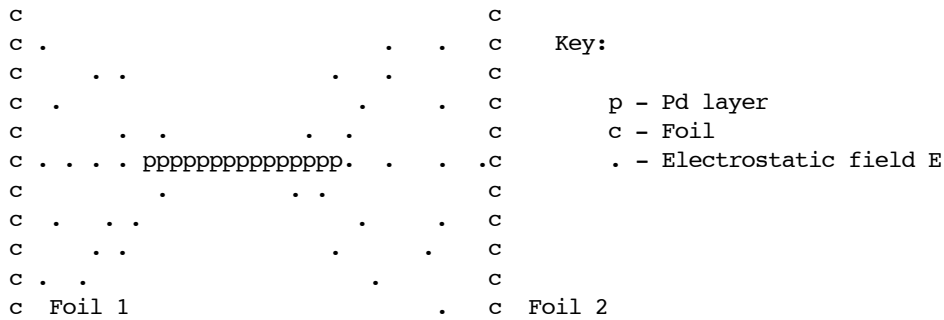


Fig. 2 - Diagram of foil plates and Pd only

Assuming Foil 1 is positive, the left side of the cathode surface p...p should contain excess free electrons, while the right side should have a deficit. The field lines enter the cathode assembly (which includes the Au) at right angles to the surface, including a portion of the surface exposed toward the anode screen. Similarly, the electrolysis current should flow not only on the p...p surface shown in Szpak's idealized Fig. 1, but also somewhat around the ends of the cathode as well. It is the areas at the left end of the cathode, specifically the interphase layers, and the adjacent electrode surface, which should experience the additive effects of the imposed E field.

More data or descriptions or photographs would be useful to understand the Szpak experiment. None the less, speculations regarding an improved design can be made.

ENHANCED SZPAK CELL

Fig. 3 below is intended to be an enhanced version of the cell of Fig. 1 in the Szpak et al paper.

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The electrolysis anode is a platinum screen with a hole cut in its center to accommodate the cathode. The face of the cathode is in effect analogous to the edge of Szpak's cathode.

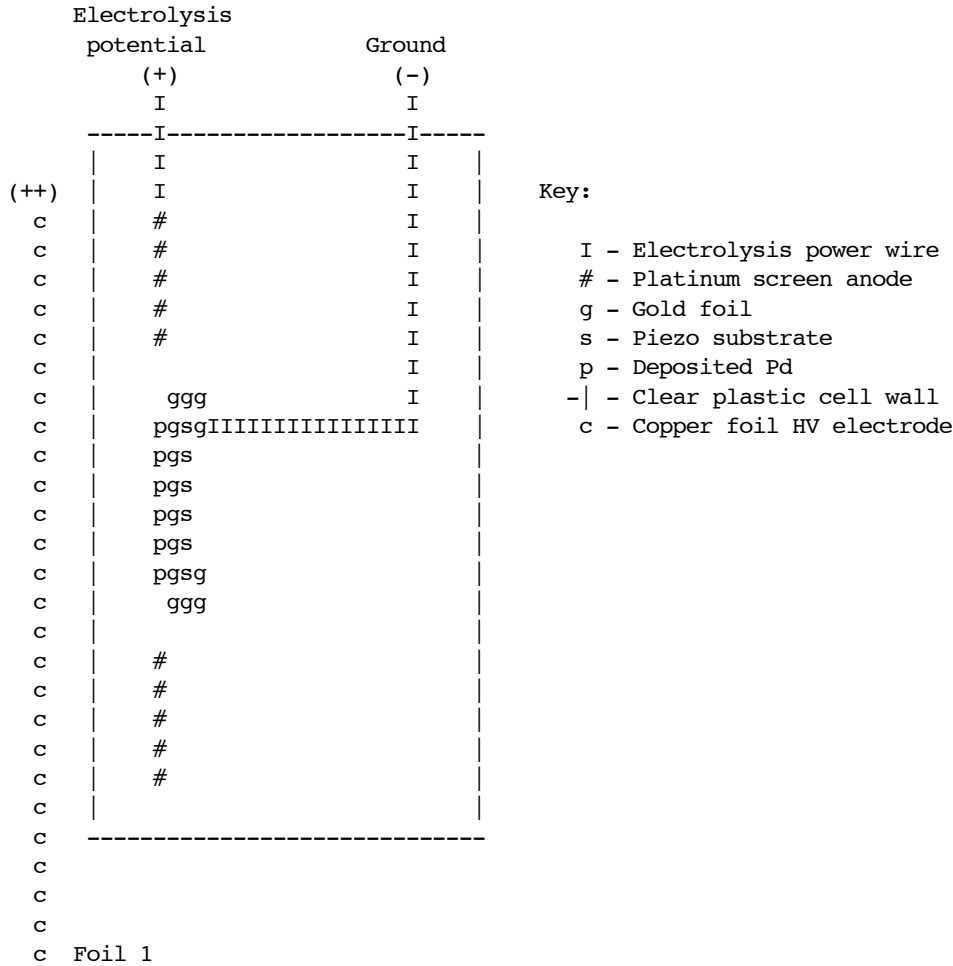


Fig. 3 - Diagram of variation on Szpak's cell

The intent of this configuration is to maximize the imposed electrostatic field imposed perpendicular to the surface of the cathode, and thus increase the electron density at the surface of the cathode. However, it is fairly clear that the vast amount of the potential drop should be across the plastic surface of the cell. Still,

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the E field is present at the interface, countered by ion redistribution and polarized molecule orientation. Within the cathode the electron distribution should be skewed toward the active surface. There may be unexpected results similar to what Szpak obtained.

The principle value of the proposed enhancement is that the effect covers the entire surface of the cathode instead of just one edge, and increases proximity of the E field generating electrodes.

EFFECTS OF IMPOSED E FIELD ON CATHODE

First, the charge balance inside the conductor is changed by the imposed field E. If the field were not actually present in the cathode, and merely balanced by the internal changes in the conductor, then this charge imbalance would not be maintained. This is one arena where the "field superposition" concept seems to cloud what is really happening inside the conductor. Second, the surface effects on the conductor can be significant and increase with the width of the conductor in the imposed field. That is to say that the field intensity in any remaining conductor-free gaps is increased by the presence of the subject conductor. Conduction band electron concentration is increased on the negative side and decreased toward the positive side. It is logical that a change in electron concentration in the conductor could have chemical and morphological surface effects.

EFFECTS OF IMPOSED E FIELD ON THE ELECTROLYTE

An electrolyte is part dielectric. It neutralizes field gradients in part by polar molecule rotation. In the electrolyte a strong electrostatic field tends to orient the H₃O⁺ ions (and H₂O) in a polar manner. A fixed orientation for some of the H₃O⁺ ions would reduce the electrolytes ability to conduct by its primary method, that being H₃O⁺ molecule rotation followed by proton tunneling. This then should increase the amount of conduction by other ions and such an increase might affect dendrite formation rates and morphology. It might also change convection currents, especially in the vicinity of dendrite tips, which could cause a change in morphology.

There is another field effect in dielectrics. That is nucleus displacement. The

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positive nucleus is displaced toward the negative external field direction. In other words, the center of charge is displaced in order to neutralize the imposed field. In some texts the nature of this charge displacement is treated as if atomic electrons act like they exist at their center of charge. The nucleus is "displaced from this center of charge" by an imposed electrostatic field. From this assumption one can calculate the nuclear displacement given a field E . This is of course a great oversimplification.

The nucleus has a much greater degree of freedom than the center of charge model indicates. That is because the nucleus is inside numerous spherical shells of electron quantum probability densities which have no net effect on the nucleus. A charge inside a spherical "Faraday cage" conductor experiences no net force upon that charge. The hydrogen nuclei in atoms in the interface, with its horrifically strong field intensities, especially in the presence of an alternating field, can experience dynamics which allow the nuclei to obtain closer distances than 0.5 the hydrogen atom radius. Yes, the Schroedinger equations will show thinning of the electron shielding and thus increased repulsion and the resurrection of the Coulomb barrier. However, protons in the H_3O^+ ion have more time for briefly imposed fields to accelerate them and they can range a larger distance than would be thought by a simple center of charge model. The same goes for electrode nuclei and adsorbed hydrogen. If a cathode surface has an increased electron concentration, due to an externally applied field E , and that field E has principally the effect in the interface of increasing the orientation of molecules by polarity, it is important to theoretically evaluate the resulting change in electron screening capacity at the interface. An increased electron concentration should increase the electron screening capacity. Nuclear fusion probability should increase with increased electron concentration.

SUMMARY

A cell design for an electrolytic cell operating on the principles of the Szpak cell has been presented. The principle value of the new cell design is that the resulting field effect covers the entire surface of the cathode instead of just one edge, and increases proximity of the E field generating electrodes, thus increasing the imposed field intensity and uniformity in across both the cathode surface and the electrolyte.