# Technical Note

## The electrocrystallization process in its footings of the new phase

**P. B. Rotti**

*KLE JT College, Gadag-582201*

*Email: jagdishrotti@yahoo.co.in*

The modern advances in technology has enabled all the branches of science to provide new insights into the origin of the universe and "Big Bang theory [1]" is a typical example. The researchers involved in the field of chemical Kinetics and the electrochemists [2-4] too are involved in new approaches, for unravelling the isomorphism between chemical kinetics and electrode kinetics. The reaction constant 'k' of the chemical reaction is often perceived as a scalar quantity by the chemical kinetics researchers whereas the electrochemists have accepted it as a vector quantity which builds up the new product from the reactants. The concentration goes as the parameter in the Kinetics whereas the electrochemists refer to the "current density" as vector parameter along with concentrations. The electrolysis process mimics the nature in almost all the oxidation and reduction reactions [5-7].

Thus, the general form of the Chemical equation

$$[\text{Reactants}] \rightleftharpoons [\text{Products}] \pm \text{energy} - ①$$

can now be expressed as

$$\left[\begin{array}{c}\textit{Mass of the concentration of the reacting material} \\ (\textbf{\textit{Scalar quantity}})\end{array}\right] + \left[\begin{array}{c}\textit{Concentration of the charge in terms of current denisty} \\ (\textbf{\textit{Vector quantity}})\end{array}\right] \rightleftharpoons \left[\begin{array}{c}\textit{Chemical substance formed within from or on the surface of the substrate cathode compex of scalar and vector quantity}\end{array}\right] \pm \text{energy} - ②$$

The product formed from the reversible reaction is ascertained by the forward directional growth of the reaction. The concepts of the reactant and the product can be clarified using derivative and antiderivative notions. The derivative term goes to the product side, leaving behind the antiderivative concept for the reactant.

Introductions of the new concepts of scalar and the electrolytes in terms of the vectors quantities leads to:

$$\left[\begin{array}{c}\textit{Mass of the concentration of the reacting material} \\ (\textbf{\textit{Scalar quantity}})\end{array}\right] \text{x} \left[\begin{array}{c}\textit{Concentration of the charge in terms of current denisty} \\ (\textbf{\textit{Vector quantity}})\end{array}\right] \rightleftharpoons \left[\begin{array}{c}\textit{Chemical substance formed within from or on to the surface of the substrate cathode}\end{array}\right] \pm \text{energy} - \{2\}$$

A B C

i.e [A][**B**]⇌**C**

in ionic forms

$$[(M^{+++})_{aq}] + \begin{bmatrix}\bar{e}\\ \bar{e}\\ E\end{bmatrix}^{\bar{e}} \rightleftharpoons {}^{\bar{e}}[(M^{++})_{aq}] + \begin{bmatrix}\bar{e}\\ E\end{bmatrix} \rightleftharpoons [(M^{+})_{aq}] + \begin{bmatrix}\bar{e}\\ E\end{bmatrix} \rightleftharpoons [M_{\text{solid atom in crystal lattice}}] \Delta = nFE - \{3\}$$

The ultimate antiderivative of $[M^{+3}]$ is the **M** itself

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The antiderivative [$\bar{e}$] is the part of the energy. The antiderivative of the universe and of the vacuum encompasses the space chemistry and the antiderivatives of space chemistry goes to **the galaxy** and so on. The above reactions can be expressed in empirical form as shown below {4}

$$[\text{Mass}]_{\text{uni}} \cdot [\text{ Vacuum}]_{\text{uni}} \rightleftharpoons \rightleftharpoons [(M^{+++})_{aq}] + [\text{Anion}_{aq}] \pm \text{energy} - \{4\}$$

The reactions of the mass and of the vacuum of {4} the universe goes on to that space of the universe which in turn goes to as that of the galaxies. These subtle concepts seem to be implied by Bragg and Bragg and Sommerfeld while studying the spectra.

Such situation has the occasion to generate chemisorbed product of the mass and vacuum which in turn generates the Electron and other ingredients of the nucleons and form ionosphere of the chain reactions of the Electron massive surfaces.

J J Thomson was successful in his endeavour to break the ATOM into two ions of oppositely charged particles (cation and electron). Willard Gibbs enunciated the Phase rule to study the heterogeneous equilibrium.

$$(P + F) = C + 2 \text{ ---------- (5)}$$

where

P = number of phases

F = number of the degrees of the freedom

C = number of components

2 = The number of natural forces required to generate 'C' from (P + F) phases

Substituting C =2,

(P+F) = 4 ----------(6)

Let this number be also an algebraic term 'z' Hence

(P + F) = z ----------(7)

Thus, one can study the influence of variables in the heterogeneous equilibrium system up to 4 phases of the universe.

The phase diagram of sulphur may be considered as a typical example, consisting of 4 phases with negative parameter

(F = -1) ---------- (8)

This negative parameter implies the presence of the vacuum within the mass. Thus, the vacuum present on both the sides of the mass plays the dual role as the potential energy and the kinetic energy respectively.

The method of electrolysis process of (0.25M $CuSO_4$ +0.M $H_2SO_4$) of aqueous solution using highly purified copper, electropolished single crystal substrate follows the equation (4). The coated surface of such crystals near its vacuum is the deposition process. So, the second step now involves the polarised form of faces of copper ions. Hence the process repeats in a cyclic manner, yielding multiple layers. There is thus the synergy between massive phase of vacuum plane on the single crystal cathodes of (100) and (111) planes respectively. The adsorption deposition process of the successive layers helps in this process. But the crystal deposits on to the surfaces (110) planes separates into two parts on either side of its central planes at ($\pi$ distance apart) giving the shape of the propeller of the planes addressed as RIDGE crystals.

The intercepts obtained in the graph of logei ->$\eta$ (Over Potentials) at 10 mA/$cm^2$ current density of 10 Coulomb/ $cm^2$ are of the magnitudes of 2,2 and 4 of (100) (110) and (111) planes and yield $i_0$ of polycrystalline substrates as

$i_0 = \sum_{100}^{111} (i_0)^2 = \sqrt{24} = 5$ No of forces imparting the surface of the crystal ----(10)

The magnitude of 'C' of the phase rule (5) goes to '2' while studying the reactions of mass and vacuum of the reversible reaction of the universe, which is confirmed by the value of 'C' of J. J.Thomson's experiments of an atom splitting into two oppositely charged particles. So if the process is on account of both the processes then the total value of C becomes 4.

The substitution of this value in the phase rule one gets

(P + F ) = 6 ---------- (9).

Let 'z' represent 6 in equation (10) then we can reach dynamic form of phase rule as

(P + F) = z --------- (10)

The differential study of equation (7) from rectangular to the hexagonal... The study of the copper crystals up to the hexagonal form, and the study of sulphur system is in the lines of equation form (5), up to the 3 phases of equilibrium and indicates a negative value for the phase of Sulphur. This may be attributed to the presence of vacuum in the interior surfaces of sulphur. And the differential study of equation (5) goes as the galvanostatic and potentiostatic crystals of electrolysis.

$(dp/de)_f = 1$ ------- (11) and $(df/dc)_p = 1$ ----------(12)

The above considerations point out to the need for the vector concepts in the electrolysis processes. The current density plays a role similar to the concentration in the chemical kinetics.

## Conclusions

The importance of the derivative and antiderivative concepts is indicated. The application of the phase rule to interpret the possible shapes of the electro crystalized products of electrolysis is emphasized in a novel manner.

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