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# Characteristics of electrolytic copper fractals

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Some of the nature's creations can be revealed as fractals which exhibit the scale invariance of their heterogeneities. Since they are stable structures over a considerable time span, it implies the ability of those fractals in achieving the lowest possible energy level. While natural fractal formations are independent of human activities, certain fractal growths can be created in a laboratory environment. Copper clusters formed during electro-deposition of ions follow the Diffusion Limited aggregation (DLA) model and exhibit fractal characteristics. These irregular dendritic aggregates start the growing process from a seed particle attached to the cathode. In this study we mainly focused on the variation of Cu dendrites grown in a circular cell with respect to the supply current and the initial metal ion concentration of the aqueous solution. The circular cell was made up with an acrylic petri dish, ring shaped copper anode placed around the edge of the petri dish and a copper rod cathode inserted at the centre of the petri dish. Copper sulphate aqueous solution was used as the medium and ions were undergone a Brownian motion until the voltage is supplied. Copper ion concentration was varied from 0.1 M to 1.5 M and supply current was varied from 0.15 A to 1.59 A. Ten sets of experiments were conducted under different ion concentrations and supply currents. Then the fractal patterns were digitalized and fractal dimensions were determined by applying the box counting method. Highest fractal dimension (1.9005) was found for the lowest ion concentration (0.1 M) and the lowest supply current (0.15 A), proving that random Brownian motion is more prominent, when the driving forces are weaker. Moreover, several linear characteristics (mass, number of primary branches, average radius) were compared. Studying the mechanism of this irreversible tree-like metal aggregates is important as it reveals the technology which can be advantageous in various fields like nano-technology, architecture, constructions and medicine.

***Keywords:*** *fractals, copper aggregates, electro-deposition, fractal dimension, dendritic pattern*