Daniel Double Fluid Primary Constant Cell Voltaic Electrolytic Galvanic

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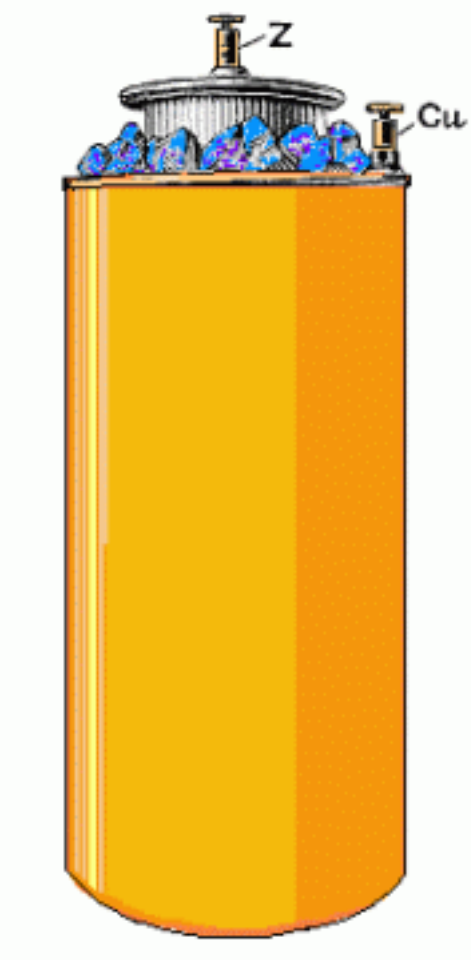

Fig 1. Daniel Double Fluid Primary Cell

The **original Volta cell made in an acid version** using sulfuric acid H_2SO_4 and the same cell was also made with an **alkaline version**, using kalium (potassium in the US) KOH hydroxide electrolyte. **None of these cells were practical**, because as soon as current was drawn, the polarization effect reduced this current to near zero. During polarization, free hydrogen and oxygen gas collects on the electrodes and polarizes them. The effect always opposes the flow of current. The generated polarizing gases reduces the cell active surface area and after a short while current no longer able to flow.

In London, Professor of Chemistry **J. F. Daniell in 1836 modified** the original Volta cell to prevent the gas to collection on the electrodes.The **Daniel cell is a double fluid primary voltaic or galvanic cell** - Figure 1. This cell and its many variants are made of copper and zinc electrodes. This cell is somewhat similar of the Bunsen cell, except that it uses copper as a positive electrode instead of carbon and different catholyte. Also, because of no gases are involved at all, this cell does not suffer from the effect of polarization.

The Daniel cell is an inverted arrangement as in most primary cells the center electrode is positive, and the outer electrode is negative. In this cell the cylindrical porous clay pot contains the 25% diluted ZnSO anolyte and the cylindrical or rod shape negative zinc electrode that is centered within the clay cylinder. All cell components are located inside a strong copper jar that is the positive electrode of this electrochemical system. The catholyte is a saturated copper sulfate $CuSO_4$ solution. To keep the catholyte saturation constant, copper sulfate crystals are added.

Like all other primary electrolytic cells, **this cell is also generating electricity by chemical action**. Chemical action results in the change of substances from their original form to a new substance with new properties. **Voltaic cells produce electrical energy by direct conversion** that is a result of a redox chemical reaction.

The **Daniel cell** has an approximate open circuit voltage of **1.1 Volt**. Using the calculation with the Faraday law the open circuit potential comes out to be 1.089 Volt exactly. At the time the available volt-meter's resolution was not that good. This cell is able to supply week current for a long time that was

used in the past for powering laboratory instruments, for low current, signaling applications and powering small electric motors. The depolarizer in the Daniel cell is copper sulfate $CuSO_4$ and sulfate crystal and $ZnSO_4$.

Many different Daniel cell variations are known and used. Daniel cell components can be left assembled after use, and the battery is continuously useable. The **Meidinger cells that are an improved version** eventually superseded the Daniel cell. Some interesting technical and historical observations continued in **Part 2**.

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