Primary Voltaic Electrolytic Galvanic Chemical Cells General Information

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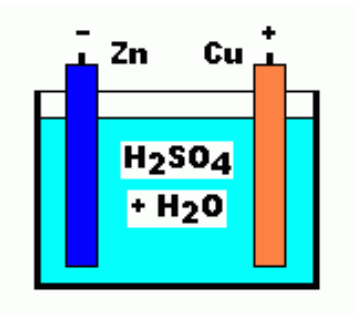

Fig 1. Voltaic Primary Cell

Voltaic or galvanic cell - **Fig. 1**. - result when two primary conductors are immersed into an electrolyte. All voltaic cells utilize one or more electrolyte and one or more different primary conductors, metals. All electrolytic cells generate 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.

At the beginning of our current electronics age, primary cells were the only source of useable electricity. After a slow evolution voltaic cells are a form of often used convenient source of portable electric energy. Voltaic cells are usually the most expensive form of electric energy.

The open circuit voltage of a galvanic cell is independent of the size of the electrodes, their distance or the volume of electrolyte and it only dependent on the electrode materials and the type of electrolyte. Electrode polarization opposes current flow. The most difficult part to develop a primary cell is to find suitable depolarizer materials. That is why some cells use a single electrolyte and others use two or more.

The rapid development for the postal, rail and transportation sectors required a large number of primary cells. The Daniell type cells with their depolarizer were immensely popular from their introduction in 1850 in the Morse telegraph service. In some special service they are still in use to this very day. The chromium acid Bunsen cells were widely used in 1910 for laboratory experiments. They often charged the newly invented first lead acid cells until steam powered dynamos became available. The Lalande type copper cells also in 1910 were often powered small electric motors, and the rail services for signaling were used some of them until recently.

Single Fluid Primary cell types:

Cell Name	**Pos. Pole**	**Neg. Pole**	**Electrolyte**	**V**	**Comments**
Air	C	Amal. Zn	20% NaOH	1.45	Air depolarized
Bichromate	C	Zn	120g $CrSO_4$+H2SO_4	2	Medium current
Clark Std	Hg+Hg_2SO_4&$ZnSO_4$	Amal. Zn	100% $ZnSO_4$	1.43	
Cupron	CuO	Zn	20-22 Be° NaOH	0.8	Strong current 1A long time
Fery	C	Amal. Zn	100% NH_4Cl	1.4	Air depolarized
Gassner dry	C	Zn	ZNO+NH_4Cl+$ZnCl_2$	1.4	MnO_2 depolarizer
Law	C	Zn	15% NH_4Cl	1.4	Air depolarized
Lalande-Edison	CuO	Amal. Zn	20% NaOH	1.1	
Lechlance	C	Zn	NH_4Cl	1.5	Strong current short time
Lechlance dry	C	Amal. Zn	NH_4Cl+$ZnCl_2$	1.6	MnO_2+C depolarizer
Main	PBO_2	Amal. Zn	H_2SO_4 - density 1.1	2.5	
Meidinger	Cu	Zn	$ZnCl_2$ - 170g/L	1	Weak current for long time
Mercury	Hg	Zn	HgO_ZnO	1.2	Med current for long time
Poggendorf	C	Amal. Zn	$K_2Cr_2O_7$+H_2SO_4+H_2O	2.0	MnO_2+C depolarizer
Regnault	Cd	Amal. Zn	H_2SO_4+$CaSO_4$+H_2O	0.34	Strong current
Siver Chloride	Ag+AgCl	Zn	23% NH_4Cl	1.0	
Volta couple	Cu	Zn	NaCl solution	1.0	First cell made
Weston normal	Hg+$HgSO_4$+$CdSO_4$	Cdam	100% $CdSO_4$	1.02	Lab standard

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Double Fluid Primary cell types:

Cell Name	+Pole	Catholyte	Neg. Pole	Anolyte	V	Comments
Bunsen	C	100% HNO_3	Amal. Zn	10% H_2SO_4	1.9	Strong current galv. Lab
Daniel	Cu	$CuSO_4$	Zn	25% H_2SO_4	2.0	Weak current for long time
Fuller	C	$K_2Cr_2O_7$+H_2SO_4	Amal. Zn	8% H_2SO_4	2.0	
Grove	Pt	100% HNO_3	Zn	8% H_2SO_4	1.5	Strong current short time
Marie Davy	C	Hg_2SO_4	Amal. Zn	12% H_2SO_4	2	
Partz	C	$K_2Cr_2O_7$+H_2SO_4	Amal. Zn	$MgSO_4$	2	Modified Bunsen

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The Lechlance type cell survived relatively unchanged since its invention in 1868. All dry cells are descendents to the original wet cell. Dry cells are not dry. Instead of the liquid electrolyte, dry cells have their electrolyte in a gel or paste form. It increases the cell resistance, but makes it possible to have portable cells for flashlights, radios, and other items.

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