DOES THIS LOOK LIKE A WAY OF SAVING ENERGY?

GENERATING LESS CARBON DIOXIDE FOR TRANSPORTATION?

THE INTERNAL RESISTANCES IN COMMON BATTERIES
MOST OF THE "INTERNALS" OF A BATTERY ARE METALS OR ELECTROACTIVE SEMI-CONDUCTORS.
BELOW ARE LISTED THE CONDUCTIVITIES OF THE USUAL METALS AND SEMI-CONDUCTORS FOUND IN MODERN BATTERIES AND ALSO THE USUAL ELECTROLYTES

Metals (Resistance)

- Pb (lead) 22×10^{-6} ohm/cm^3
- Ni (nickel) 7×10^{-6} ohm/cm^3
- Fe (iron) 10×10^{-6} ohm/cm^3
- Cd (cadnium) 7.6×10^{-6} ohm/cm^3
- Cu (copper) 1.72×10^{-6} ohm/cm^3

Semi-Conductors

- Generally ~ 10^{-3} ohm/cm^3

Electrolytes

- H_2SO_4(sulfuric acid) (5 M) ~1 ohm/cm^3
- KOH (potassium hydroxide) ~5M) ~2ohm/cm^2
- The internal resistance therefore exists 99% in the electrolyte.

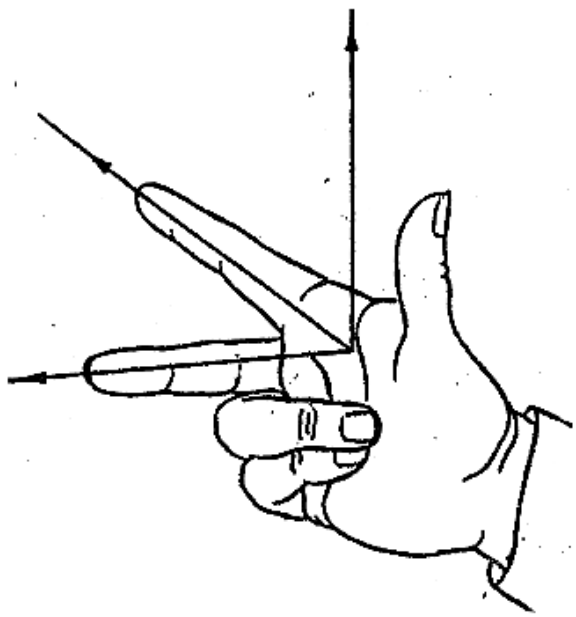
A USEFUL STRAGEGY THEN, WOULD BE TO TRY TO INCREASE CONVECTION

MECHANICAL STIRRING HAS BEEN TRIED – IN THE ROTATING DISK, IN THE DROPPING MERCURY ELECTRODE (ANALYTICAL ONLY), AND BY PUMPING AS IN ELECTROMACHINING

RIGHT HAND RULE

Thumb (Current)

Forefinger(Field)



Centre finger (Motion)

The magnetic field (H) interacting with the current (upward flow of ions at the cathode (C) and downward at the anode (A)) gives a force into the cell and out of the cell causing precession of the convective path, lower viscosity and more rapid stirring.

A USEFUL STRAGEGY THEN, WOULD BE TO TRY TO INCREASE CONVECTION

THE DIRECTION OF ROTATION OF AN ELECTRIC MOTOR IS GIVEN BY THE RIGHT HAND RULE, THAT IS THE DIRECTION OF THE MAGNETIC FIELD, THE ELECTRIC CURRENT AND THE DIRECTION OF ROTATIONAL FORCE ARE ALL MUTUALLY AT 90 DEGREES TO EACH OTHER.

THE MOTION OF THE ELECTROLYTE MUST THEN BE ACROSS THE FACE OF THE ELECTRODES

AT THE CATHODE THE NATURAL CONVECTION IS NORMALLY UPWARD AS IONS ARE DISCHARGED

ADDITION OF THESE TWO VECTORS RESULTS, USUALLY, IN AN UPWARD SPIRAL AT THE CATHODE AND A DOWNWARD ONE AT THE ANODE

USING THE FRESNEL FORCE, AS IN THE ROTATION OF AN ELECTRIC MOTOR, IS MORE EFFICIENT IF THE ELECTRODES ARE MAGNETIZED TO HAVE OPPOSITE MAGNETIC POLES ON THEIR TWO FACES

WE BELIEVE THAT THE HIGH DRAIN WHEN UNMAGNETIZED CAUSED SOME DETERIORATION

IN THE ELECTROCHEMICAL CELL, THE CONVECTING STREAM OF IONS, EITHER UP OR DOWN IS THE ELECTRIC CURRENT – NOT THE PASSAGE OF ELECTRICITY FROM THE FACE OF ONE ELECTRODE TO THE OTHER

TO BE MUTUALLY PERPENDICULAR THE MAGNETIC FIELD MUST BE FROM THE FACE OF ONE ELECTRODE TO THE FACE OF THE OTHER.

MAGNETOHYDRODYNAMICS AS A GENERAL ELECTROCHEMICAL ENHANCER

OF THESE THREE PROCESSES, CONVECTION AT VERTICAL ELECTRODES WITH LIQUID ELECTROLYTE, WILL DOMINATE IF THE PROCESS IS DONE IN THE EARTH'S GRAVITATIONAL FIELD.

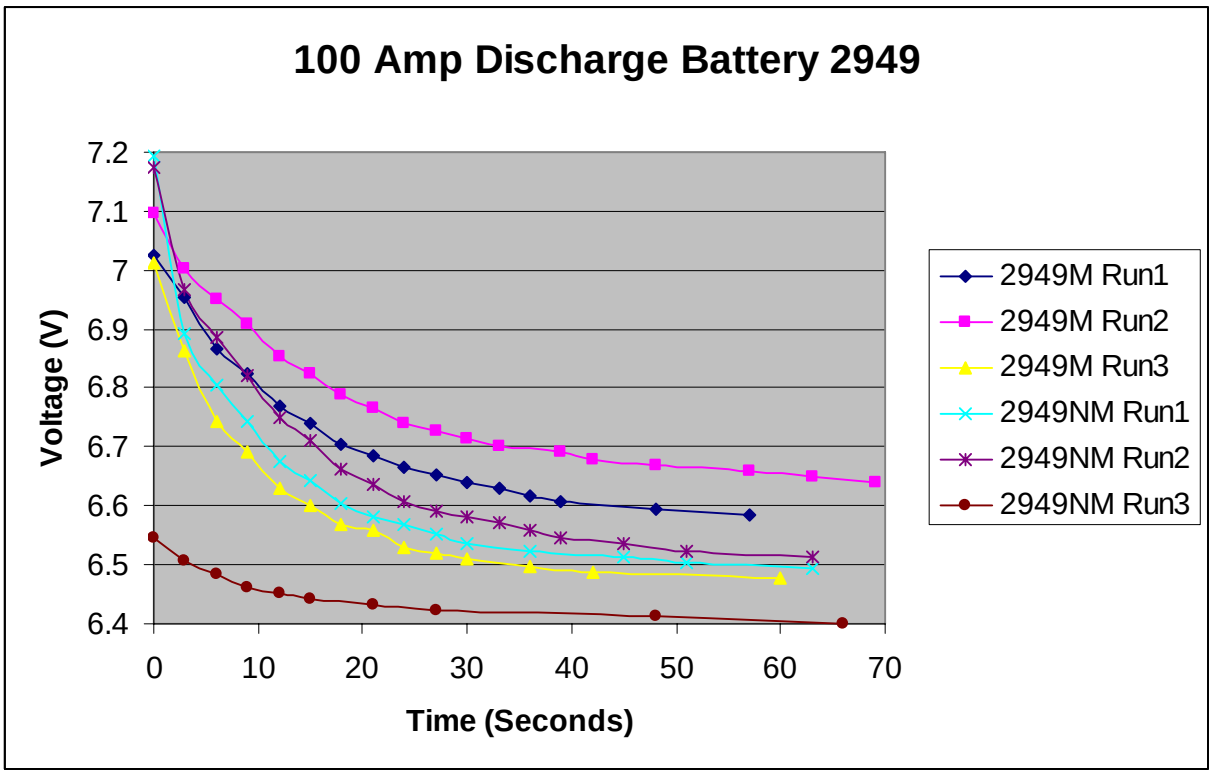
IN SEVERAL EXPERIMENTS WITH FLOATED PARTICLES, ENHANCEMENT OF THE RATE OF CONVECTION, OR TRANSPORT OF ACTIVE IONS, HAS BEEN OBSERVED TO BE OVER TWO ORDERS OF MAGNITUDE

THE RESULT WAS A VERY LARGE DECREASE IN THE ELECTROLYTE RESISTANCE, OR THE LOSS OF ENERGY IN OVERCOMING AN UN-NECESSARY RESISTANCE IS LARGELY ELIMINATED

MAGNETOHYDRODYNAMICS AS A GENERAL ELECTROCHEMICAL ENHANCER

IN ANY ELECTROCHEMICAL PROCESS THE GENERAL DESIGN PROCEDURE IS FIRST TO SELECT ELECTRODES THAT ARE GOOD CATALYSTS FOR THE REACTION CONTEMPLATED.

THIS WILL MEAN THAT THE ELECTROCHEMICAL PROCESS RATE WILL NOT BE CONTROLLED BY THE CHEMICAL REACTION RATE, BUT BY THE TRANSPORT PROCESSES – MIGRATION, DIFFUSION, AND CONVECTION



HIGH RATE DISCHARGE OF STANDARD PRODUCTION BATTERIES (15C)

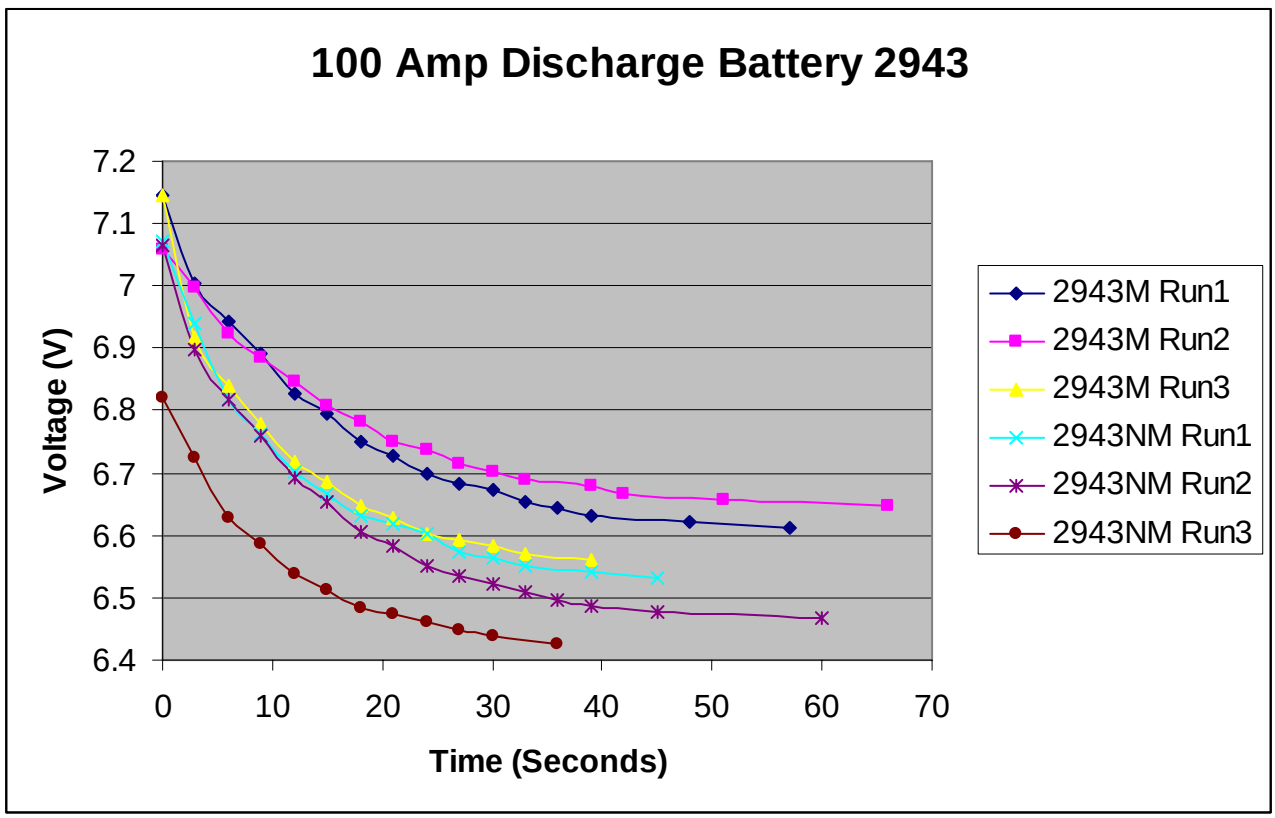
MODULES FOR TRACTION BATTERIES OF A POPULAR BRAND NAME

SUPPLIED BY A LARGE BATTERY MANUFACTURER

3 NiMH PRODUCTION MODULES TESTED BEFORE MAGNETIZATION AND AFTER

TESTED BY VIZON SCITEC VANCOUVER

2943


100 Amp Discharge Battery 2943
Voltage (V)
7.2
7.1
7
6.9
6.8
6.7
6.6
6.5
6.4
0
10
20
30
40
50
60
70
Time (Seconds)
2943M Run1
2943M Run2
2943M Run3
2943NM Run1
2943NM Run2
2943NM Run3

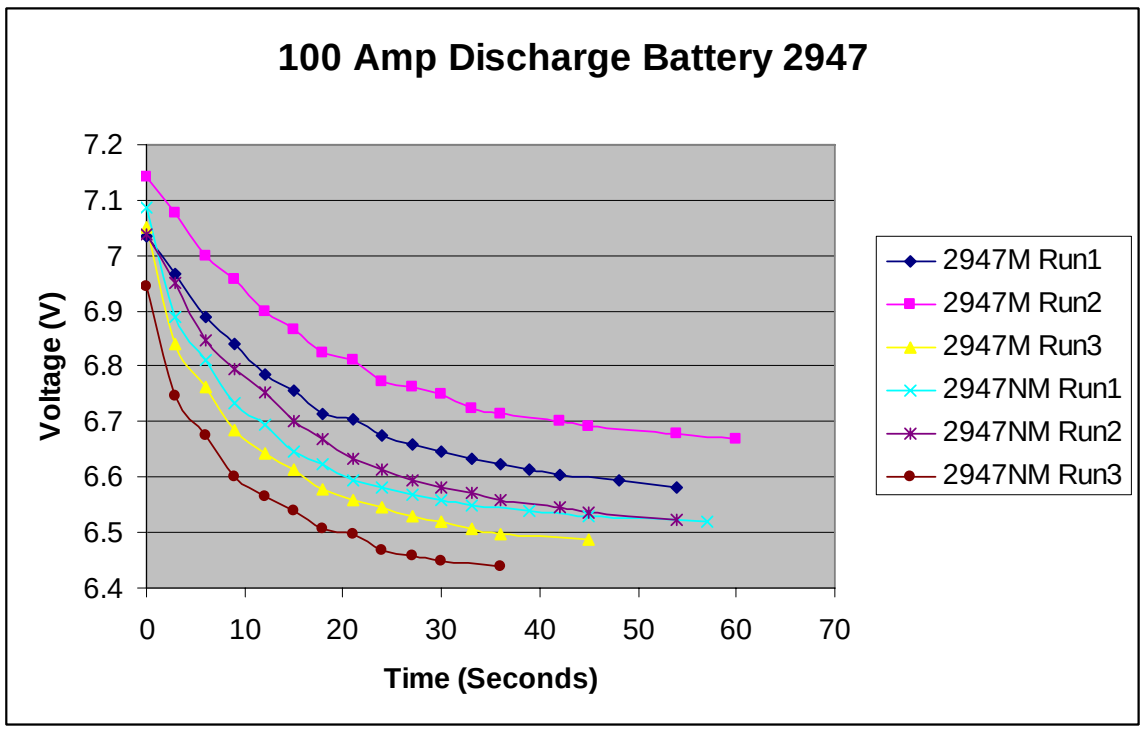

100 Amp Discharge Battery 2947
Voltage (V)
7.2
7.1
7
6.9
6.8
6.7
6.6
6.5
6.4
0
10
20
30
40
50
60
70
Time (Seconds)
2947M Run1
2947M Run2
2947M Run3
2947NM Run1
2947NM Run2
2947NM Run3

TABLE 1

COMPARISON OF PERFORMANCE OF NON-MAGNETIZED AND MAGNETIZED NiMH BATTERIES (3, 100 AMP RUNS)

BATTERY	RUN #	INCREASE	BATTERY	RUN#	INCREASE
2943	1	16%	2947	1	13%
	2	28		2	23
	3	32		3	15

BATTERY	RUN #	INCREASE
2949	1	15%
	2	18
	3	32

ARITHMETICAL AVERAGE OF THE THREE = 26.3%

MORE LIKELY AVERAGE IS ~ 32%

COMPARISON OF IMPROVEMENT ASSUMPTION/LIMITATIONS

1. WHEN A TEST WAS STOPPED AND RETESTED BEFORE ONE MINUTE, FOR THE NON-MAGNETIZED RUN, THE CURVE FOR A MAGNETIZED RUN WAS CONSIDERED TO HAVE STOPPED AT THE SAME TIME FOR FAIRNESS

2. THIS PROCEDURE FOR FINDING THE AREA UNDER THE CURVE (WATT SECONDS) WAS POINTED OUT IN COMMENTS ON THE PLOTS FOR #2947, AND WAS USED FOR ALL PERCENTAGE INCREASES IN PERFORMANCE.

COMPARISON OF IMPROVEMENT ASSUMPTION/LIMITATIONS

3. ONLY #2947 DID NOT INCREASE IN PERFORMANCE WITH EACH RUN, BUT ACTUALLY DECREASED USING THE “FAIRNESS” PROCEDURE.

4. NO ACCOUNT WAS TAKEN OF THE VOLTAGE TIME CURVE EXTENSION FOR THE MAGNETIZED RUNS IN EXCESS OF THE NON-MAGNETIZED RUNS – FURTHER INCREASE?

   32 + ? = 40% ??

TEN OF THESE MODULES MAKE UP ONE TRACTION BATTERY FOR A HYBRID AUTOMOBILE.

A 100 AMP DISCHARG IS THEN 1000 AMP CAPABILITY FOR ONE MINUTE …

… A SEVERE TEST

THE REASON FOR STOPPING WAS PRESUMED TO BE OVER-HEATING AND/OR PRESSURE

NOTE THAT IT OCCURRED MUCH SOONER FOR THE UN-MAGNETIZED RUNS WHICH WERE DONE FIRST – THEN THE SAME CELLS MAGNETIZED AND RETESTED

IN CHARGING A MAGNETIZED BATTERY, ALMOST ALL OF THE ENERGY APPLIED IS STORED IN THE USUAL ELECTROCHEMICAL WAY, AND ON DISCHARGE AGAIN, MOST OF IT IS AVAILABLE FOR WORK

THE PLOTS OF THE DISCHARGE OF THE NiMH BATTERIES SHOWED THIS INCREASE IN PERFORMANCE. THE NEXT PANEL SHOWS MHD APPLIED TO THE MANUFACTURE OF $NaClO_3$ ELECTROCHEMICALLY

FLOODED, TWO CELL ELECTRODE

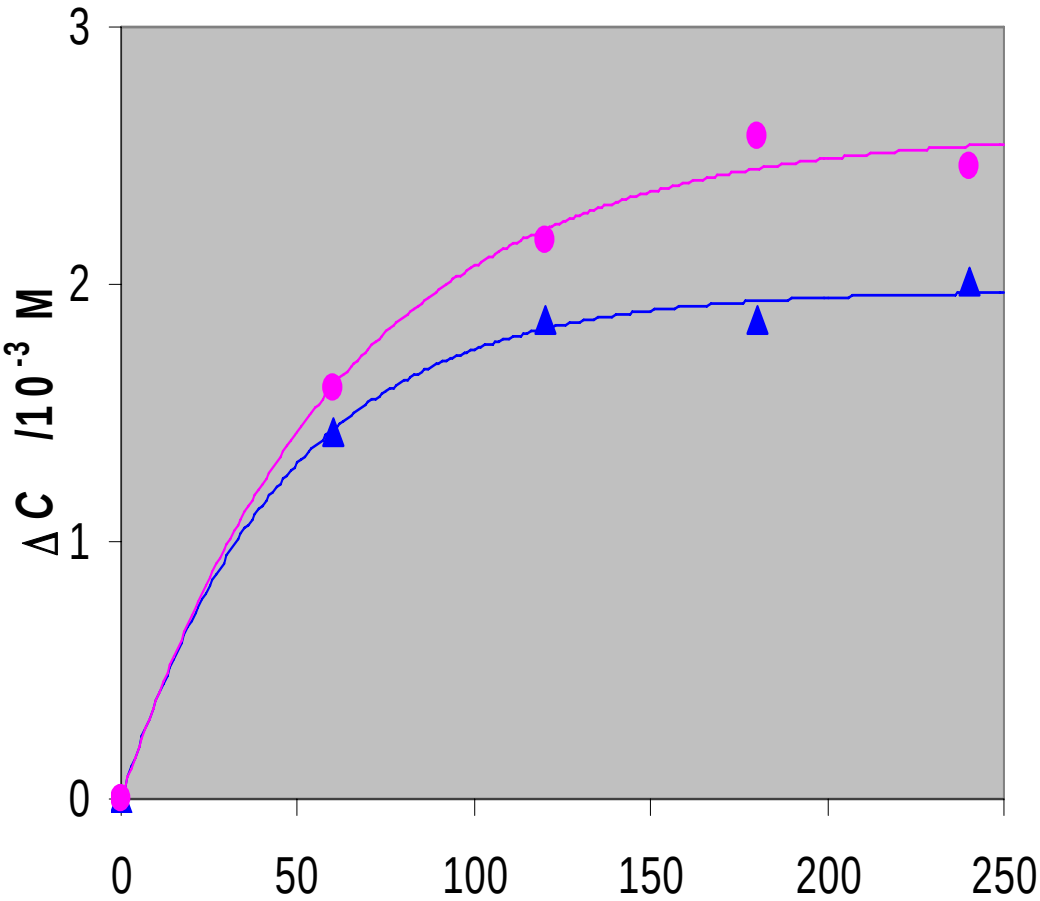
BATTERIES MADE FROM SPARE VARTA BATTERIES, ONE PREVIOUSLY MAGNETIZED, ONE NOT, WERE TESTED AND THE DRB CAN. SCIENTISTS AND THE NRC CAN. SCIENTISTS SAW RESULTS WHERE THE MAGNETIZED BATTERY PERFORMED ALMOST AN ORDER OF MAGNITUDE BETTER, ALL AGAIN AT FLEXIBLE SOLUTIONS' LAB

NOTE #2947 – THE TRIAL WAS ABANDONED AT ~ 35 SECONDS WHEN UNMAGNETIZED, BUT WHEN LATER MAGNETIZED AND RETESTED WENT 10 SECONDS LONGER AT THE HIGHER VOLGAGE … ~ 6.5 TO 6.45 V

CONSIDERING AGAIN 2947 (THE WORST PERFORMER), AND COMPARING THE UN-MAGNETIZED RUN WITH THE FIRST MAGNETIZED RUN, THE FOURTH 100 AMP DRAIN, THE MAGNETIZED RUN IS FLAT AT ONE MINUTE AND 6.7 V - A REMARKABLE RECOVERY.

THE OTHER TWO MODULES ARE ALSO REMARKABLE IN THAT EACH MAGNETIZED RUN IS BETTER THAN ANY UN-MAGNETIZED RUN.

THE INCREASED CONVECTIVE EFFECT OF INDIFFERENT PARAMAGNETIC IONS



NEW DIRECTION IN ELECTROCHEMISTRY

Energy saving magnetohydrodynamics

IN ALL ELECTROCHEMICAL PROCESSES, BATTERIES (INCLUDING NiMH, Li-ion) ELECTRODEPOSITION AND ELECTROPRODUCTION, THE DIRECTION OF RESEARCH AND APPLICATIONS IS IN THE DIRECTION OF LESS MOBILE ELECTROLYTE (BATTERIES) OR MORE ELECTROLYTE IN MOST OTHER PROCESSES (ELECTROWINNING, ETC.)

IN BATTERIES, THE TARGET OF "SHIPPING DRY" HAS LEAD TO LESS ELECTROLYTE, AND IN SOME CASES, ABSORPTION OF THE ELECTROLYTE IN A POROUS SEPARATOR. THIS INEVITABLY MEANS MORE RESISTANCE (WASTE OF ENERGY) ON CHARGING AND (WASTE OF ENERGY) ON DISCHARCING. … For hybrids lower gas mileage)

Li ION BATTERIES

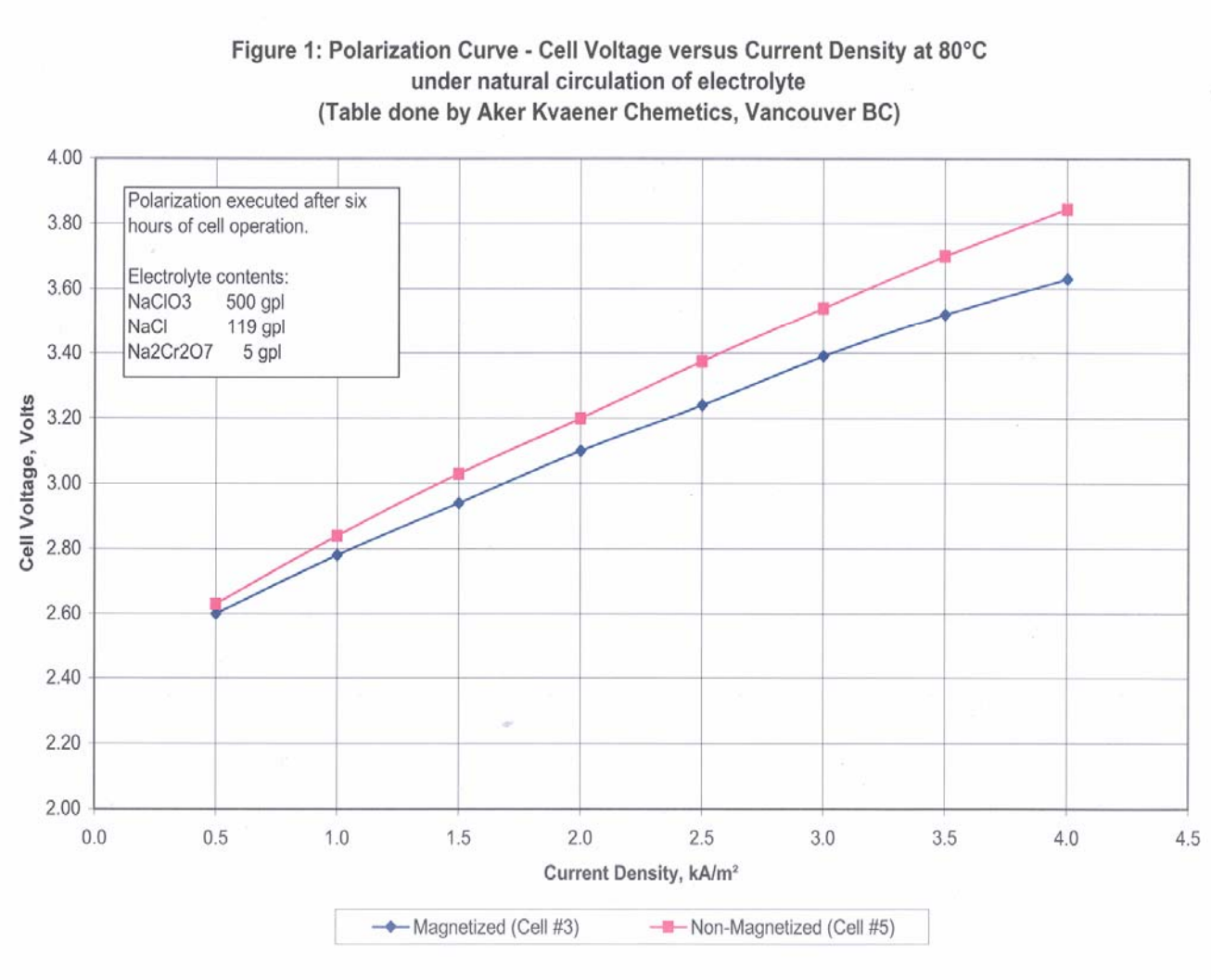
CHARACTERISTICS

- **HIGH INTERNAL RESISTANCE OF ORGANIC ELECTROLYTE SOLUTIONS**
- **LEADS TO WASTAGE OF SUPPLIED ENERGY TO HEATING SOLUTION**
- **LEADS TO SLOW RECHARGING**
- **IN USE, WASTAGE OF STORED ENERGY IN HEATING THE SOLUTION IN AND OUT**
- **LEADS TO FIRE, EXPLOSION**

REMEDY

- **USE FERROMAGNETIC CORE FOR ELECTRODES (BOTH) AND MAGNETIZE (Fe, Ni OR Co)**
- **PLATE WITH REQUIRED METAL – (Cu, Al etc.) COAT WITH ELECTROACTIVES, ADD A PARAMAGNETIC INDIFFERENT ION OR A PERMANENT FREE RADICAL**
- **EXPECT REDUCTION IN INTERNAL RESISTANCE OF AT LEAST 30%**

Fig.1: POLARIZATION CURVE



THE LIMITATION ON CURRENT DENSITY AND HENCE PRODUCTION PER DAY IS THE AMOUNT OF OXYGEN PRODUCED.

THIS IS BECAUSE THE CATHODE IS PRODUCING ALMOST 100% HYDROGEN AND AT A CERTAIN CURRENT DENSITY OXYGEN PRODUCTION OCCURS AT THE ANODE.

THE EXPLOSION RANGE FOR PURE HYDROGEN IN PURE OXYGEN IS FROM ABOUT 4% TO ABOUT 94%, THE WIDEST RANGE OF ANY GAS. SO THE LIMIT OF THE CURRENT DENSITY IS WHEN THE UNWANTED OXYGEN BEING PRODUCED APPROACHES A PREDETERMINED RANGE LESS THAN 4% WHEN NO FURTHER VOLTAGE IS APPLIED.

OTHER PROCESSES WHERE SOME RESEARCH HAS BEEN DONE: GENERATION OF HYDROGEN BY THE ELECTROLYSIS OF WATER

IN EXPERIMENTS CONDUCTED IN FLEXIBLE SOLUTIONS INTERNATIONAL LABORATORY BY FLEXIBLE'S TECHNICIANS AND WITNESSED BY NATIONAL RESEARCH COUNCIL OF CANADA'S SCIENTISTS AND ONE OF CHEMETICS, 75% OF THE ELECTROLYTE RESISTANCE WAS OVERCOME WITH MHD

IN ANOTHER SERIES OF HYDROGEN EVOLUTION EXPERIMENTS AT FLEXIBLE SOLUTIONS' LABORATORIES AS ABOVE, SCIENTISTS OF DEFENCE RESEARCH BOARD CANADA RECORDED AGAIN 75% LESS ELECTROLYTE RESISTANCE IN THE MAGNETIZED CELL

Energy saving magnetohydrodynamics

IN ELECTROWINNING, ELECTROREFINING OR ELECTROLYTIC PROCESSES GENERALLY, FEAR OF FRACTALS (OUT GROWTH OF E.G. “TREES”) HAS RESULTED IN LARGE SEPARATION OF ELECTRODES, HENCE HIGHER RESISTANCES DUE TO GREATER PATH LENGTH AND ENERGY WASTAGE ON LOW CONDUCTIVITY ELECTROLYTE COMPARED TO METAL AND SEMI-CONDUCTORS IN THE CELL.

APPLICATIONS:

UTILITY LOAD SMOOTHING – THE 11 P.M. DECLINE IN POWER DEMAND … CHARGE MAGNETIZED BATTERIES AGAINST 5 P.M. SURGE, OR ELECTROLYZE WATER FOR USE IN FUEL CELLS AT 5 P.M.

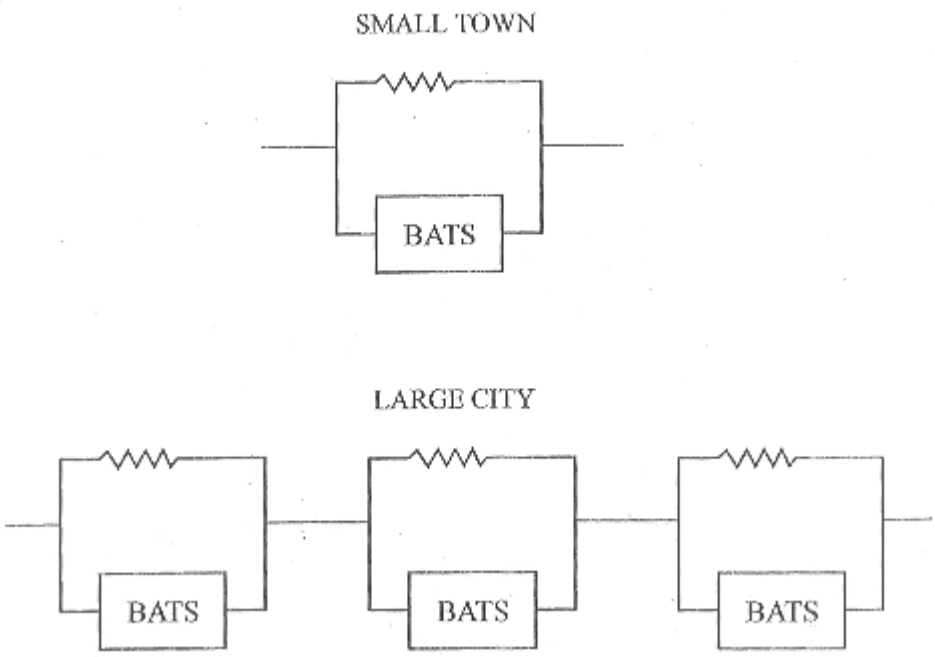
INTERMITENT GENERATION: WIND AND SOLAR GENERATION, CHARGE BATTERIES OR GENERATE HYDROGEN AND OXYGEN AS STORAGE AT PEAK PRODUCTION TO DRAW ON IN THE DARK AND CALM DAYS.

TRACTION BATTERIES FOR HYBRID VEHICLES, ROADABLE OR NOT: SINCE THE CHARGING OF THE BATTERIES WILL BE BY GASOLENE MOTOR, IF THE SUPPLIED ENERGY IS STORED AT 90% AND THE STORED ENERGY CAN BE SUPPLIED TO THE WHEELS AT 90%, WHAT WOULD A CAR GETTING 50 MILES TO THE GALLON EXPERIENCE IN INCREASED MILEAGE?

…75 MILES TO THE GALLON? … MORE?

GENERAL UTILITY LOAD SMOOTHING

WITH ONLY 3 TIME ZONES ACROSS THE USA, THE GENERAL HABITS OF THE ELECTRIC UTILITY USERS BECOMES IMPORTANT. WHEN EVERYONE GOES TO BED AND MOST ELECTRICAL EQUIPMENT IS SHUT OFF – EVEN THE AIR CONDITIONER USES LESS POWER AS THE NIGHT COOLS. THE GRID HAS MORE POWER AVAILABLE THAN CAN BE SHUNTED ON INTO THE NEXT TWO TIME ZONES. THERE ARE NOT THREE, BUT MORE THAN SIX HOURS, SO A STORAGE DEVICE FROM WHICH POWER CAN BE TAKEN FOR THE PEAK PERIODS OF FIVE PM TO EIGHT PM IS SHOWN, PLUS THE LOWERING OF LINE RESISTANCE LOSSES POSSIBLE WITH A BANK OF BATTERIES.



MAGNETIC FIELD ALTERATION IN MAGNETIZING A FOUR ELECTRODE BATTERY

Fig. 1

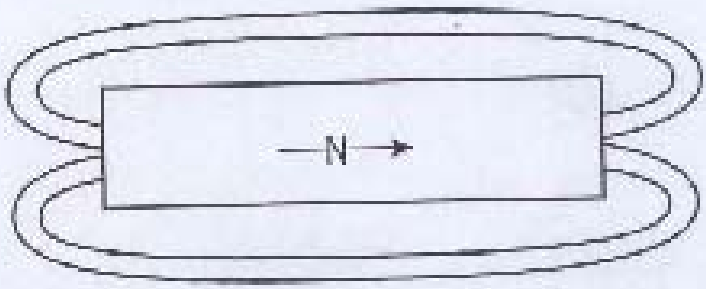


Fig. 2

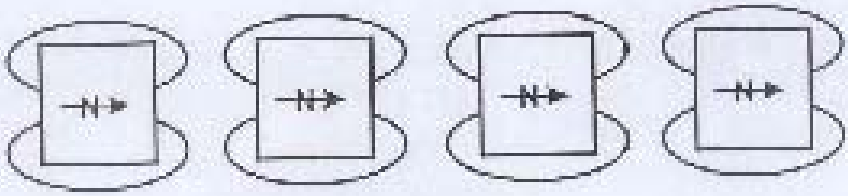


Fig.3

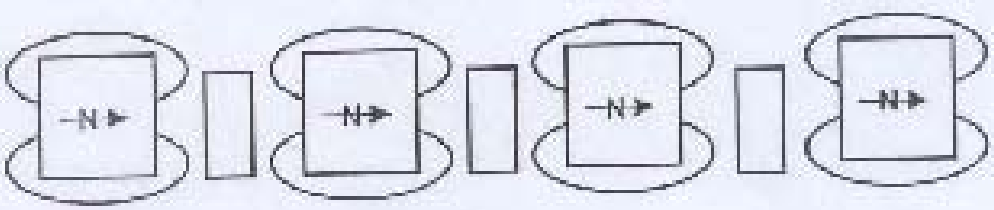
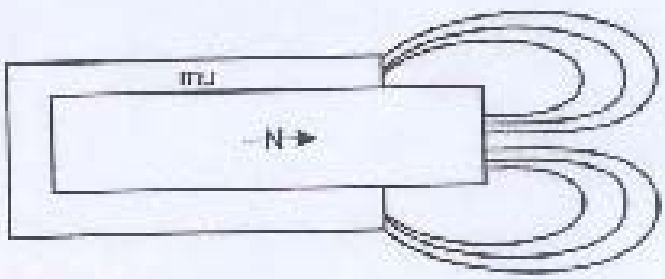


Fig. 4



MAGNETIC FIELD ALTERATION IN MAGNETIZING A FOUR ELECTRODE BATTERY

If a bar magnet (Fig. 1) is cut into four pieces (Fig. 2), four smaller, lower Magnetic field magnets are produced.

This is analogous to magnetizing a four Electrode battery, except that they are separated by electrolyte (Fig. 3) which further constricts the projected field and its strength.

Fig. 4 shows how by wrapping the bar magnet of Figure 1 in mu metal or soft iron, the field can be extended /projected further into the surrounding medium.

Fig.4 applies directly to the O'Brien magnetizer but is not used in the batteries studied.

MAGNETOHYDRODYNAMICS HAS BEEN TESTED IN NEW WORLD BATTERIES LABORATORIES FOR ELECTROWINNING, ELECTROREFINING, ELECTROPOLISHING AND ELECTROMACHINING. IT IS PLANNED TO DEMONSTRATE THESE TO SUITABLE AUDIENCES IN THE NEAR AND MIDTERM FUTURE.

UNTESTED FURTHER LIKELY CANDIDATES FOR BETTER PERFOMRANCE WITH MAGNETOHYDRODYNAMICS: ANY ELECTROCHEMICAL PROCESS FOR PRODUCING PRODUCTS OTHER THAN SODIUM CHLORATE. PRECURSORS FOR SOME PLASTICS ARE PRODUCED IN TONNAGES SOME PHARMACEUTICALS PRODUCED BY FERMENTATION PRODUCE RACEMATES WHICH ARE RESOLVED ELECTROCHEMICALLY. WE HAVE PRODUCED ADHERANT CONDUCTIVE COATINGS BY ELECTROCHEMICAL POLYMERIZATION.

THE LIST IS LONGER THAN THIS.

PATENT PROTECTION

1. **US5,051,157 (09/24/91) Aimed at the lead acid battery, but also electrowinning, electroplating, electropolishing and electromachining, the technology since much improved.**

2. **US6,194,093 B1 (03/25/01) Four of the most common batteries, lead-acid, NiCd, NiMH and Zn-air covered for magnetohydrodynamics (MDH) improvement in charging and efficiency in discharging.**

3. **US6,556,424 (04/29/03) Magnetized supercapacitor aimed at passing power in hybrid autos or fuel cell cars.**

4. **US6,741,440 B2 (05/25/04) The O'Brien magnetizerTM, the method of magnetizing electrodes for MHD in batteries, reciprocating; now superseded by a new application for a patent for a rotating version for larger electrodes and more rapid magnetization.**

5. **US7,045, 042, H_2 by water electrolysis, (05/16/05). A method of eliminating about 75% of the resistance of the electrolyte. Aimed at fuel cell cars.**

6. **US6,836,098 (09/30/04) Uses both #'s 2 and 3 to effect a fast charge with no heating or deterioration of the batteries or supercapacitor. Accommodates regenerative braking in fuel cell cars and hybrids safely.**

Regular patent applications are in for a number of advances, including one for Li-ion in which the generation of heat is reduced to almost the level of water electrodes and charging is faster and more energy efficient.

Another on a switching device that can be switched to fast charging for control of regenerative braking, and to recharging of the supercapacitor and magnetized batteries while being driven.

Other applications: Magnetized reverse osmosis application prevents fouling of the membranes, magnetized rapid electrochemical resolving of a racemate in pharmaceuticals, more rapid production of electrochemical products such as in precursors.

SPECIFIC ENERGY VS SPECIFIC POWER

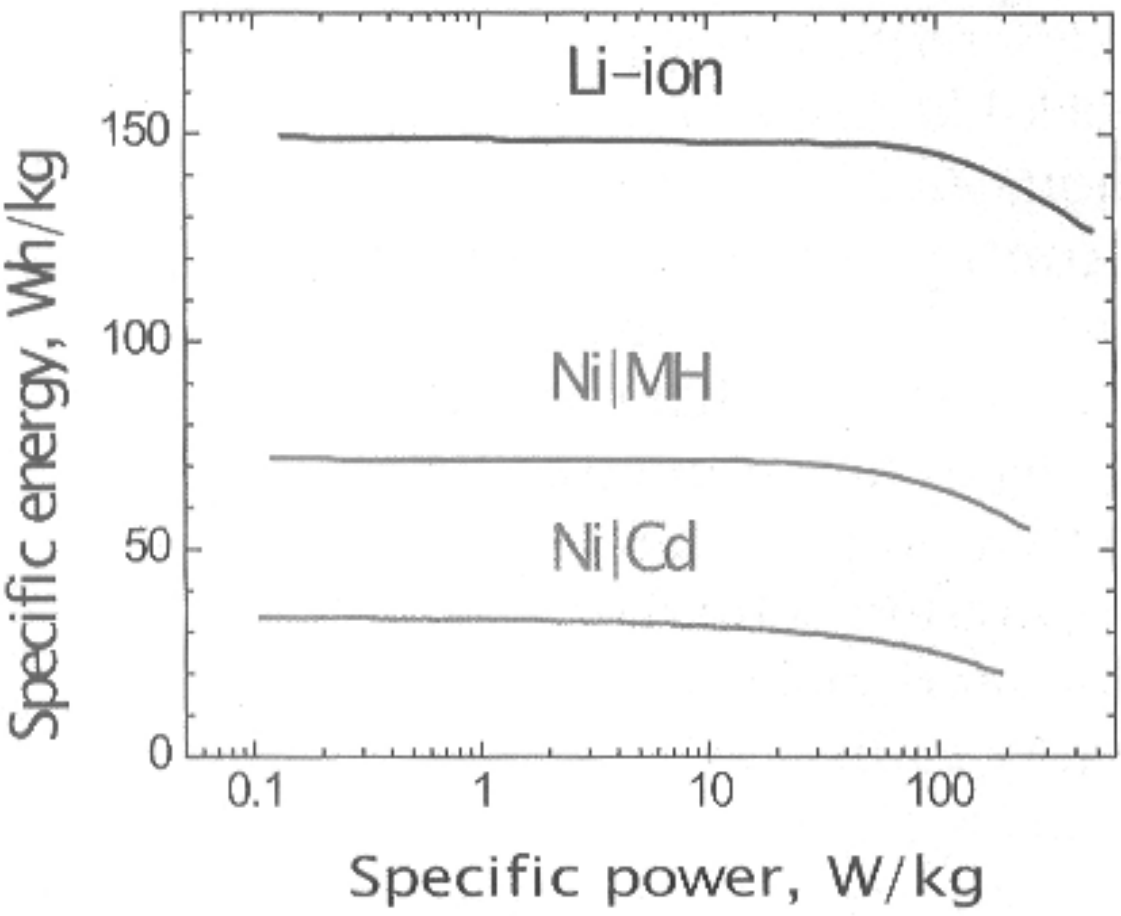
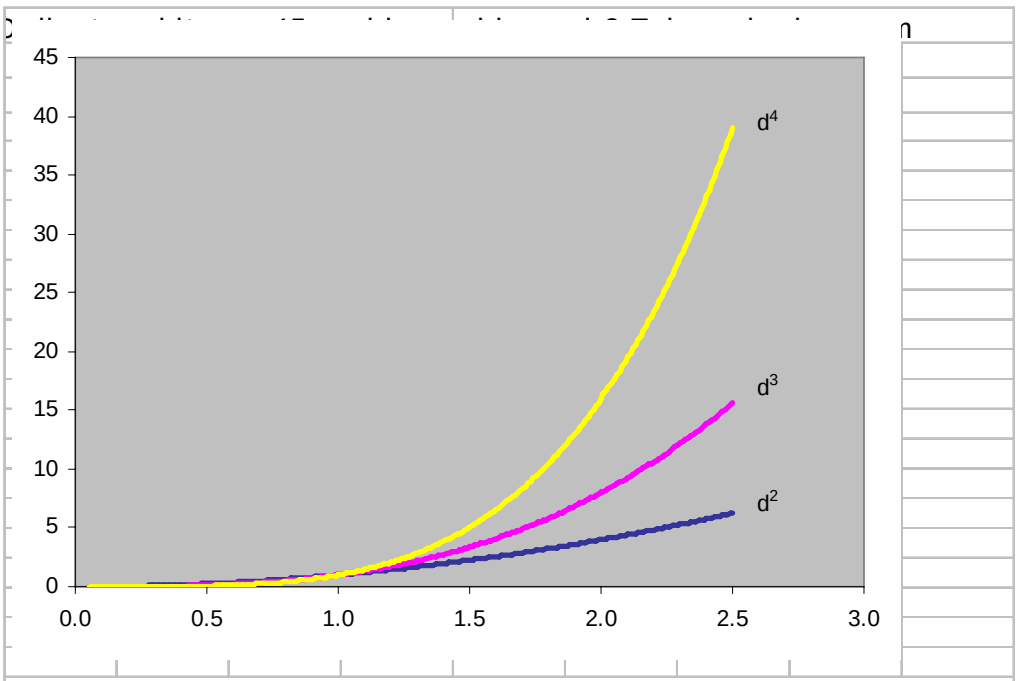


FIG. 3. Specific energy vs. specific power or Ragone plots, for three common rechargeable batteries. Ref: Handbook of batteries, D. Linden, T. B. Reddy, Eds., McGraw-Hill, New York (2002), 3rd Edition.

MAGNETIC HAMMERING



Ordinate arbitrary, 45 could equal 2 Telsa, abscissa, cm

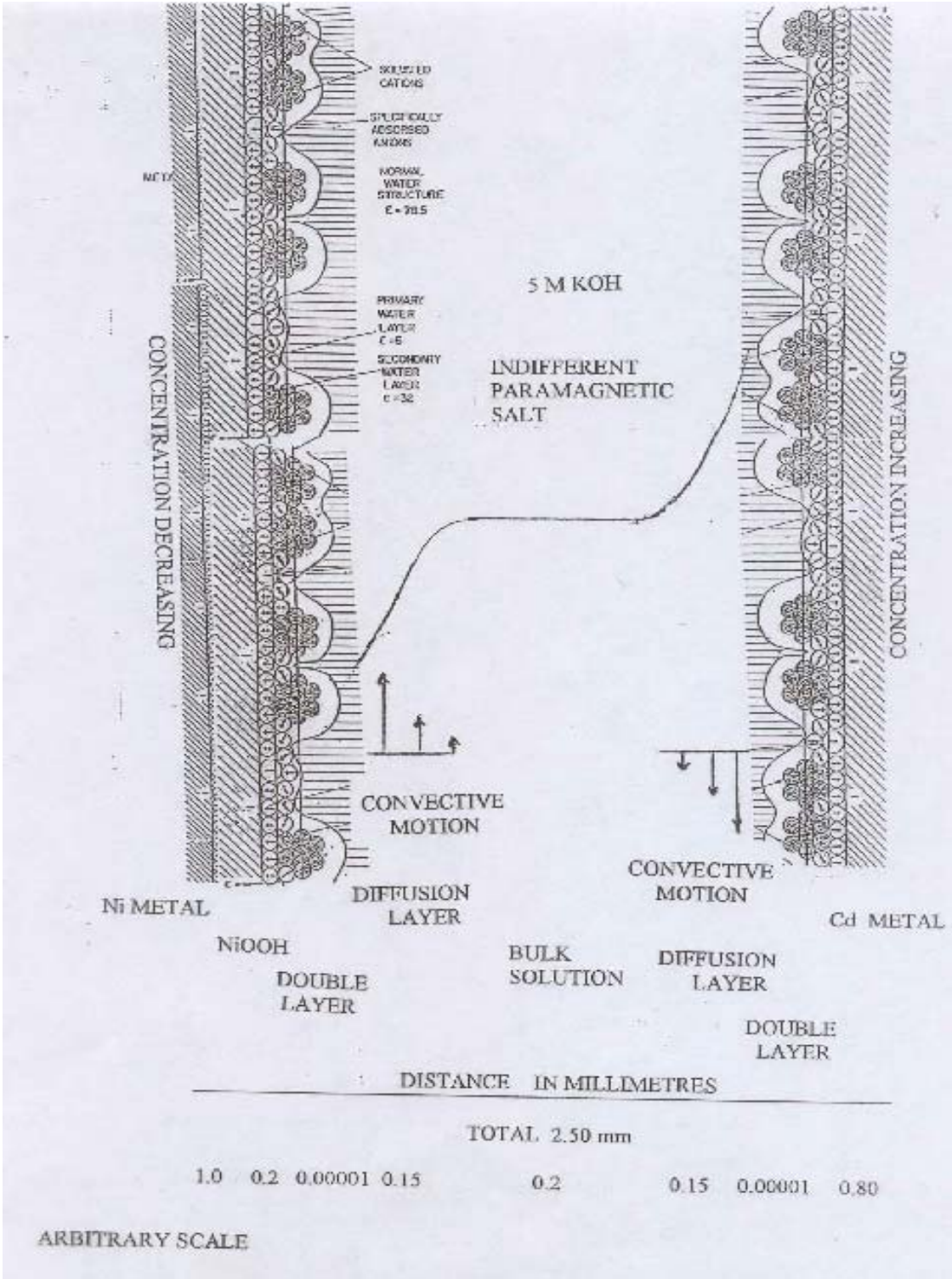
ILLUSTRATION ONLY

d^4 (MAGNETS RAPIDLY ACCELERATING TOWARD SUBSTRATE)

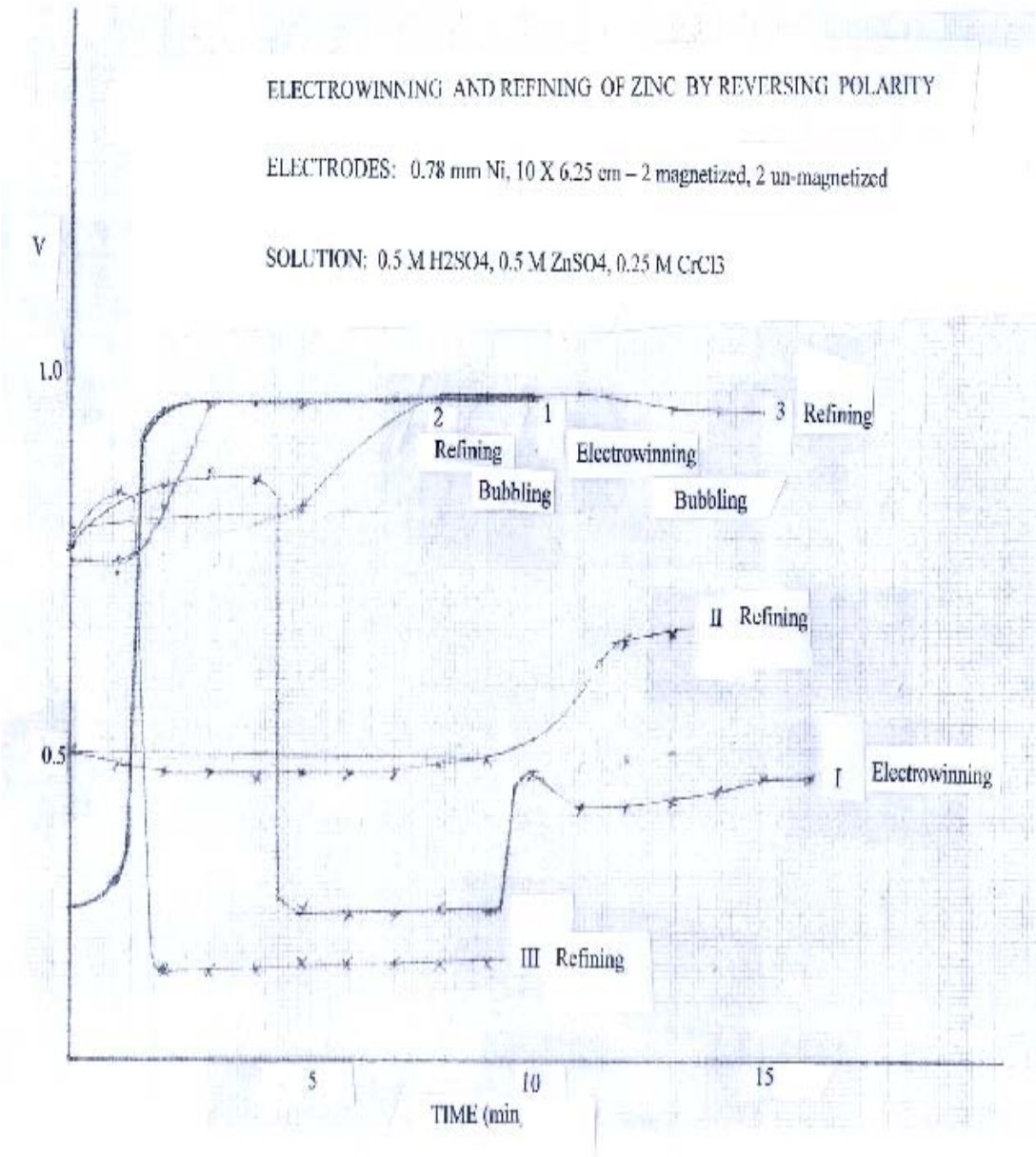
d^3 (MAGNETS ACCELERATING TOWARD SUBSTRATE)

d^2 (STATIC, OR MAGNETS ADVANCING SLOWLY)

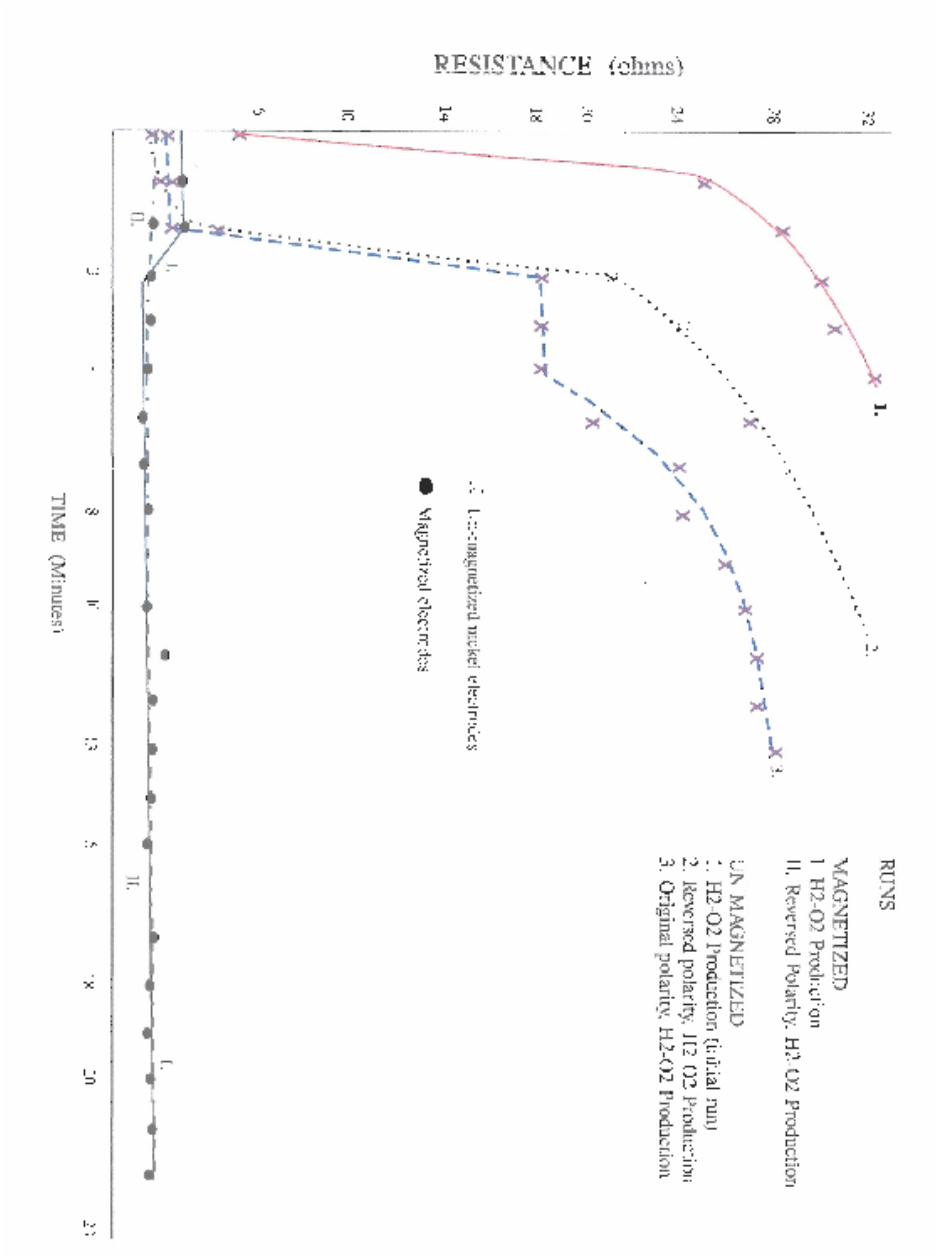
ARBITRARY SCALE



Electrowinning and Refining of Zinc



Resistance vs. time



Hydrogen Generated Electrolysis of Water