



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/cm³
- Ni (nickel) 7×10^{-6} ohm/cm³
- Fe (iron) 10×10^{-6} ohm/cm³
- Cd (cadmium) 7.6×10^{-6} ohm/cm³
- Cu (copper) 1.72×10^{-6} ohm/cm³

Semi-Conductors

- Generally $\sim 10^{-3}$ ohm/cm³

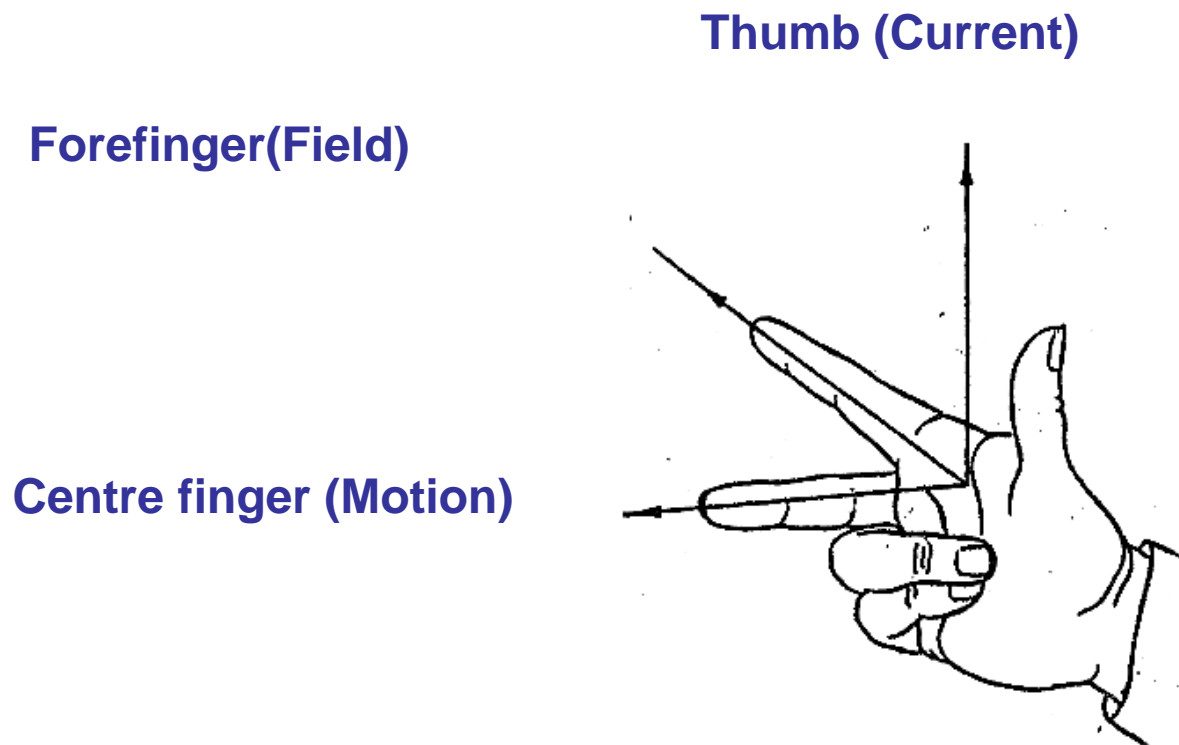
Electrolytes

- H₂SO₄(sulfuric acid) (5 M) ~ 1 ohm/cm³
- KOH (potassium hydroxide) ~ 5 M)
 ~ 2 ohm/cm²
- The internal resistance therefore exists 99% in the electrolyte.

**A USEFUL STRATEGY 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



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 STRATEGY 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 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.**

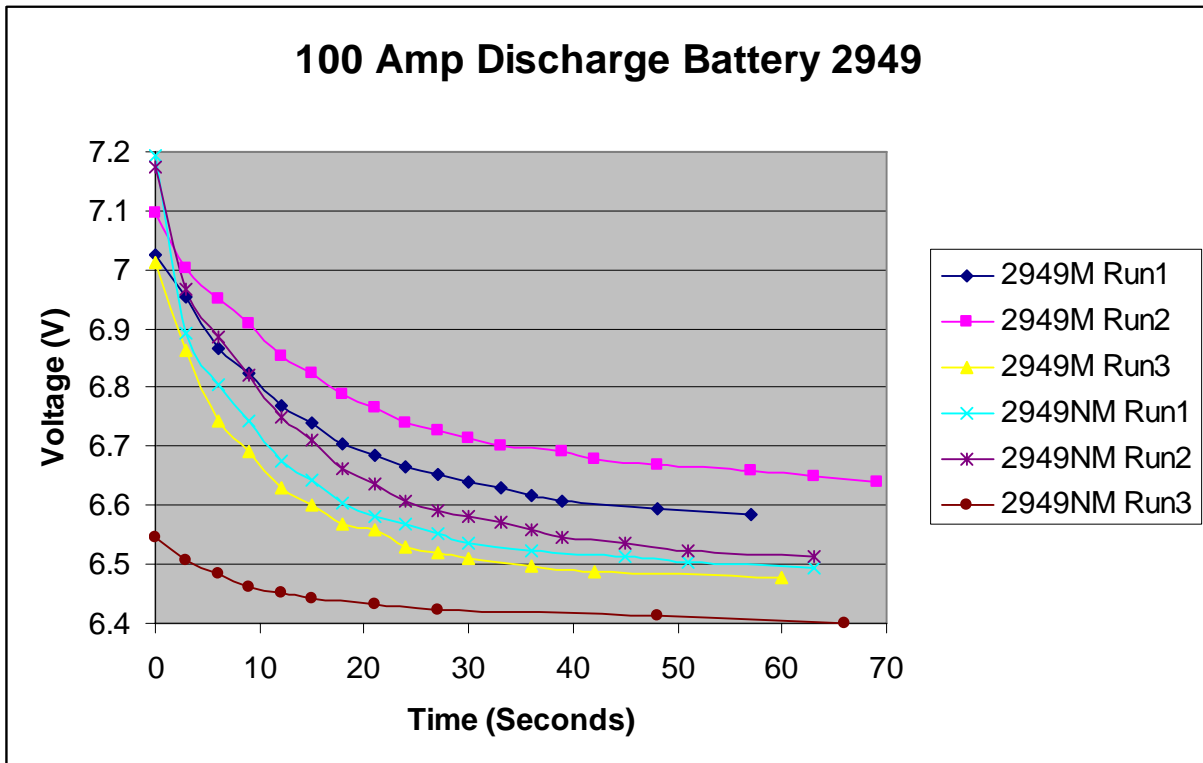
**IN SEVERAL EXPERIMENTS WITH
FLOATED PARTICLES,
ENHANCEMENT OF THE RATE
OF CONVECTION, OR
TRANSPORT OF ACTIVE IONS,
HAS BEEN OBSERVED TO BE
OVER TWO ORDERS OF
MAGNITUDE**

**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

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

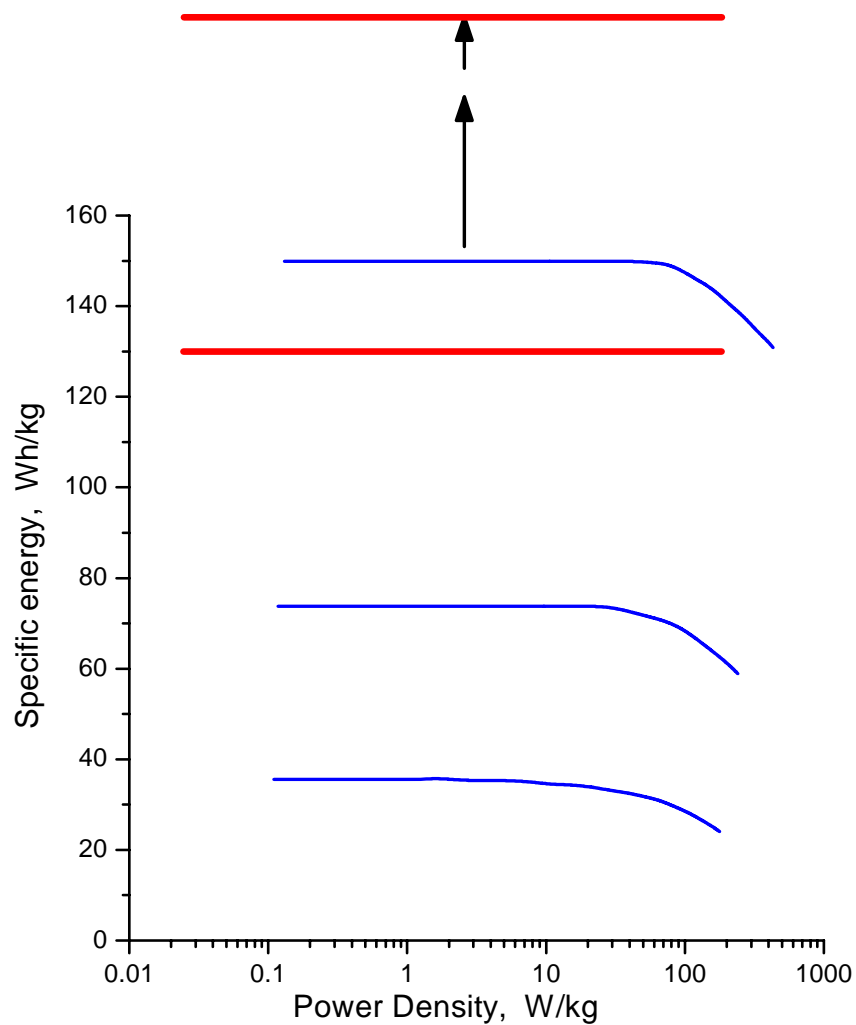
BATTERY RUN # INCREASE

2949	1	15%
	2	18
	3	32

ARITHMETICAL AVERAGE OF THE THREE = 26.3%

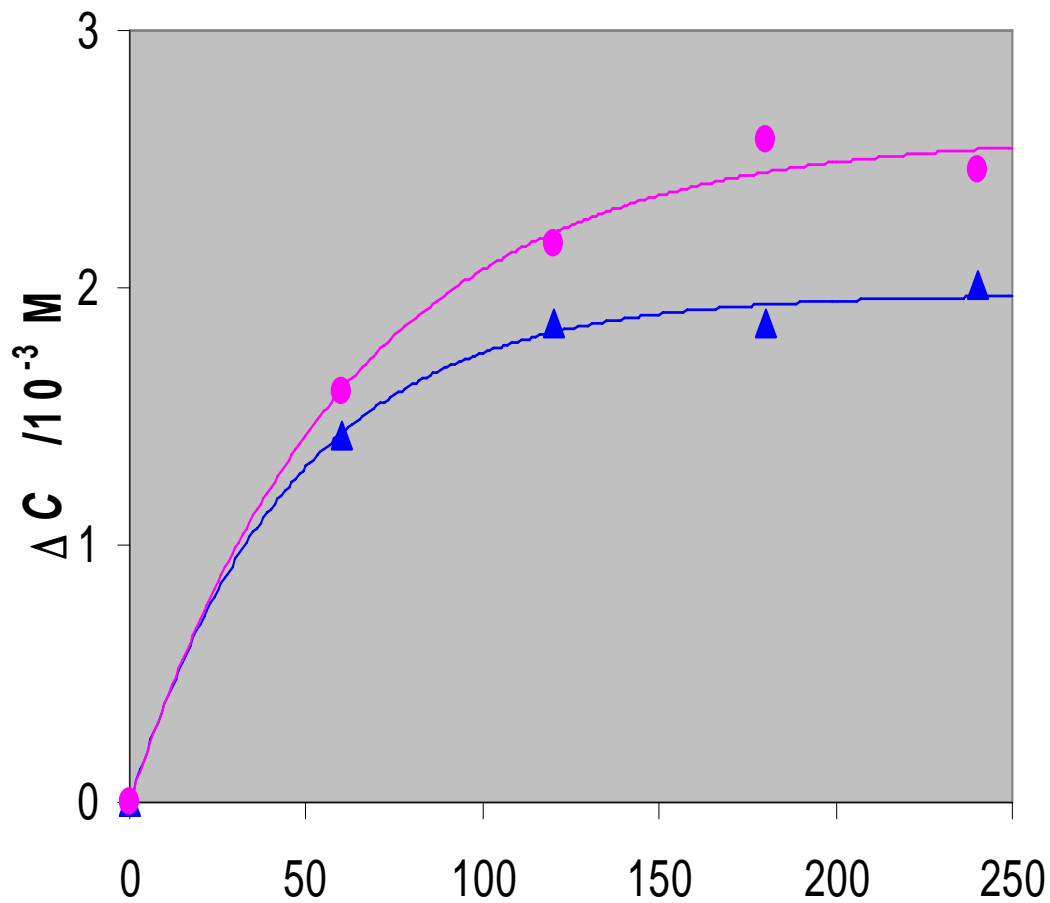
MORE LIKELY AVERAGE IS ~ 32%

Altered Ragone Plot: Effect of Decreased Resistance



**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**

THE INCREASED CONVECTIVE EFFECT OF INDIFFERENT PARAMAGNETIC IONS



Li ION BATTERIES

CHARACTERISTICS

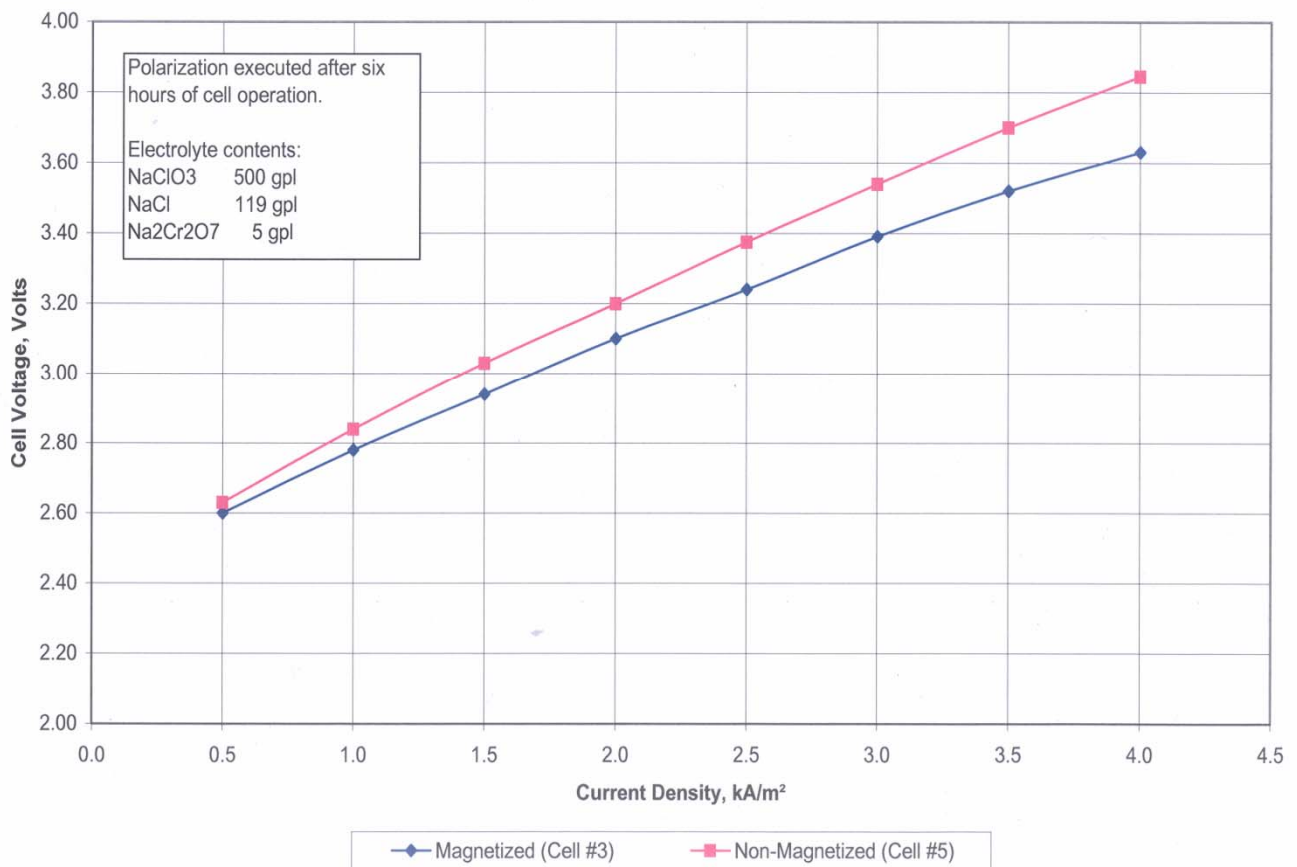
- HIGH INTERNAL RESISTANCE OF ORGANIC ELECTROLYTE SOLUTIONS
- LEADS TO WASTAGE OF SUPPLIED ENERGY TO HEATING SOLUTION
- LEADS TO SLOW RECHARGING
- IN USE, WASTAGE OF STORED ENERGY IN HEATING THE SOLUTION IN AND OUT
- LEADS TO FIRE, EXPLOSION

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

Figure 1: Polarization Curve - Cell Voltage versus Current Density at 80°C under natural circulation of electrolyte
(Table done by Aker Kvaener Chemetics, Vancouver BC)



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

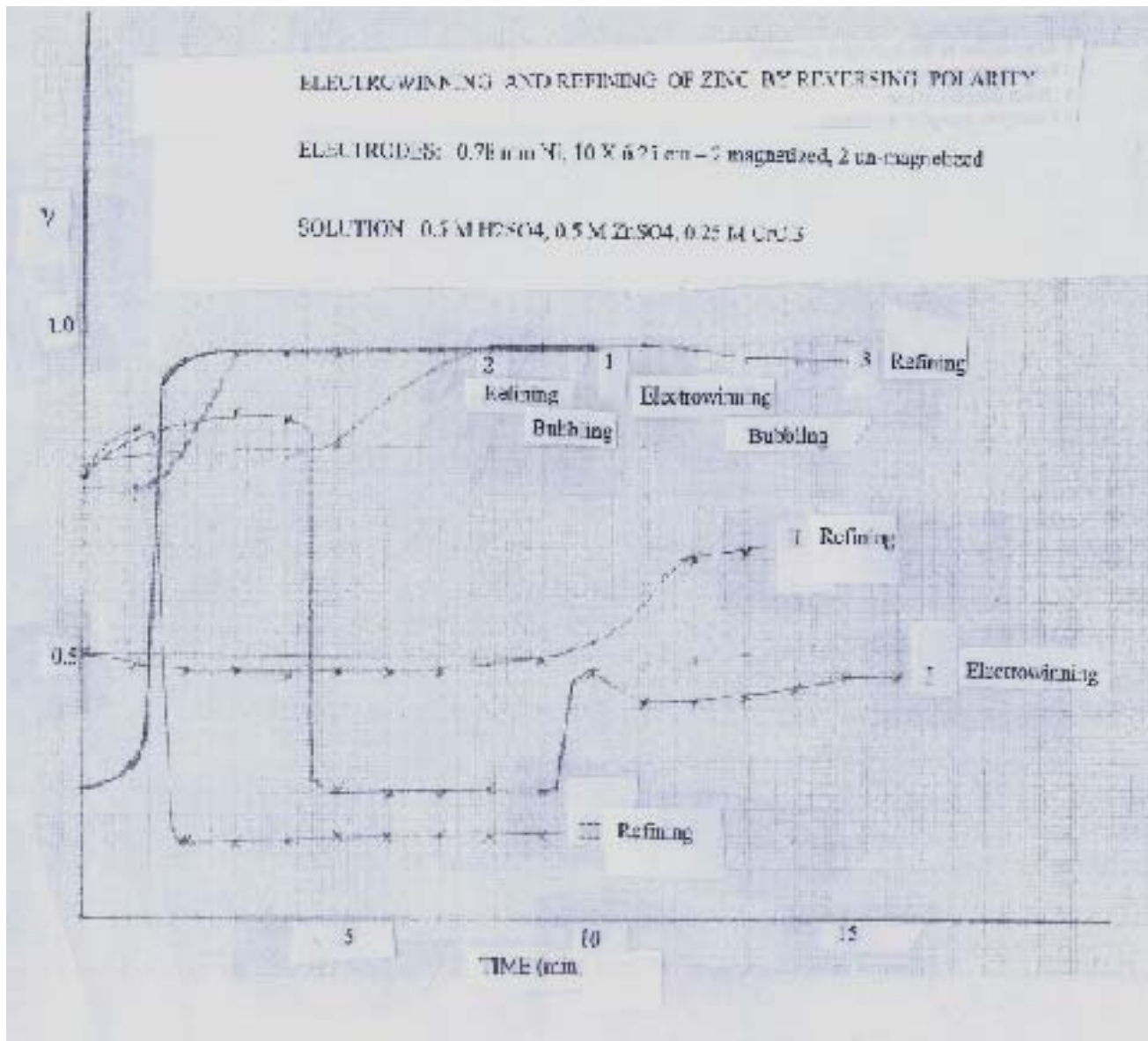
IN EXPERIMENTS CONDUCTED IN FLEXIBLE SOLUTIONS INTERNATIONAL LABORATORY BY FLEXIBLE'S TECHNICIANS AND WITNESSED BY NATIONAL RESEARCH COUNCIL OF CANADA'S SCIENTISTS AND ONE OF CHEMETICS, 75% OF THE ELECTROLYTE RESISTANCE WAS OVERCOME WITH MHD

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

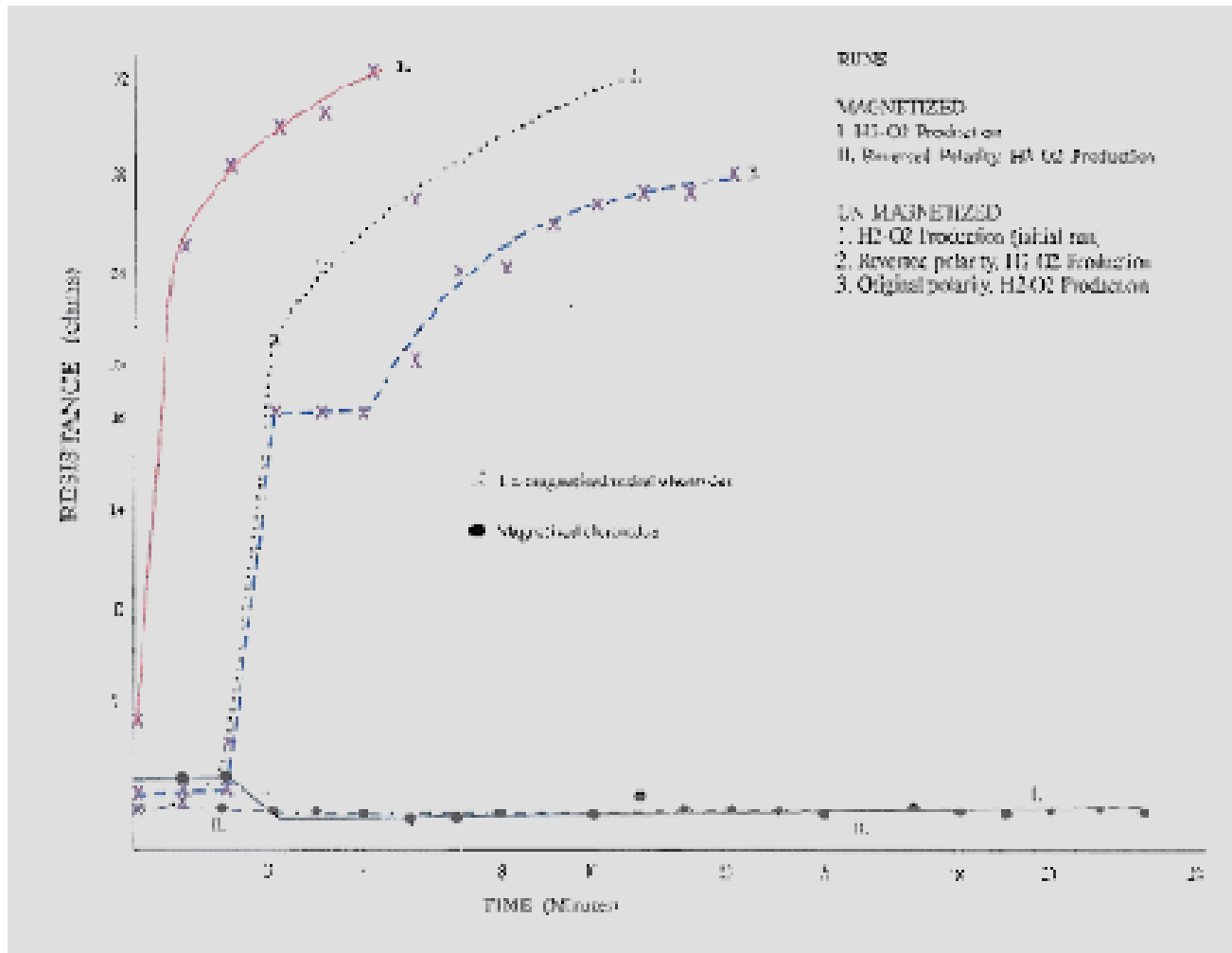
Energy saving magnetohydrodynamics

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.

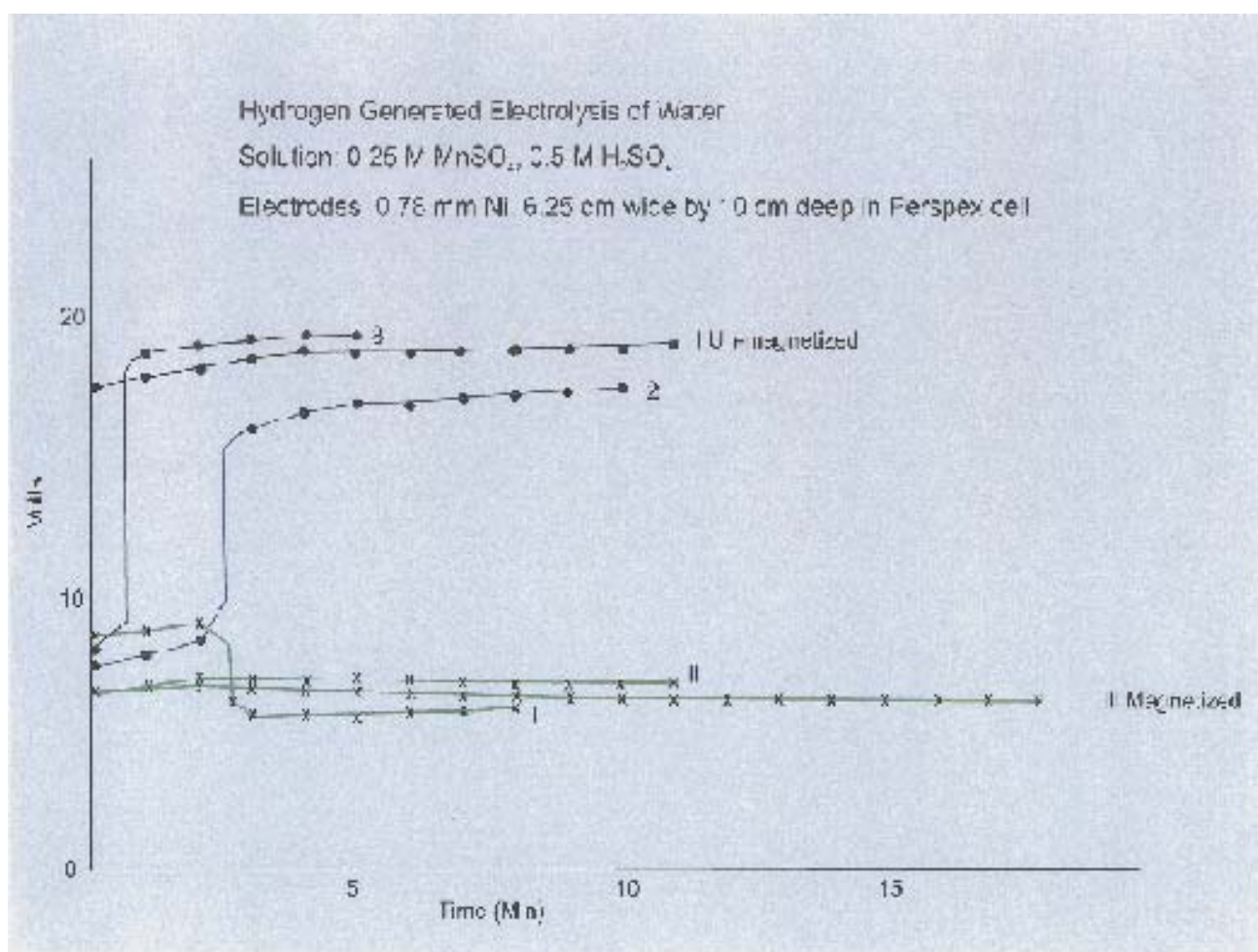
Electrowinning and Refining of Zinc



Resistance vs. time



Hydrogen Generated BY Electrolysis of Water



2007 PRIUS PERFORMANCE BATTERY PACK AS RECEIVED NEW

CITY DRIVING ONLY

AVERAGE OF TWO TRIALS IN DECEMBER 2007

50.39 MPG 5.63 L/100K

47.8

AVERAGE OF TWO 49.1

**WITH MAGNETIZED BATTERY PACK - TWO TRIALS NOV. & DEC
07**

75.7 MPG 3.75L/100K

74.5

AVERAGE OF TWO 75.1

BENEFIT OF MAGNETIZED BATTERY = 53.5 %

TOYOTA BROCHURE

72.2 MPG