Thin and flexible, fully printed batteries

BASMATI Workshop
23rd of November 2017,
Enginyers Barcelona

Outline

- Company Presentation VARTA Microbattery
- Printed batteries in general
- Electrochemical systems
- Application

Company Presentation
VARTA Microbattery

Company figures

Founding of VARTA Microbattery GmbH on August 10th 2002 as an independent company with worldwide subsidiaries and branches

Headquarters: Ellwangen, Germany
area 10 ha

Management: Herbert Schein (CEO)
Hannes Höhmüller (CFO)

Employees: Germany: 785
worldwide: 2.000

Turnover: approx. 190 Mio. €

Company Presentation
VARTA Microbattery

VARTA

VARTA MICROBATTERY

Retail

powerone

OEM | Powercaps

VARTA

Applied Basic Research

VARTA micro innovation

VARTA STORAGE

Residential Storage Systems

VARTA

Power Pack Solutions

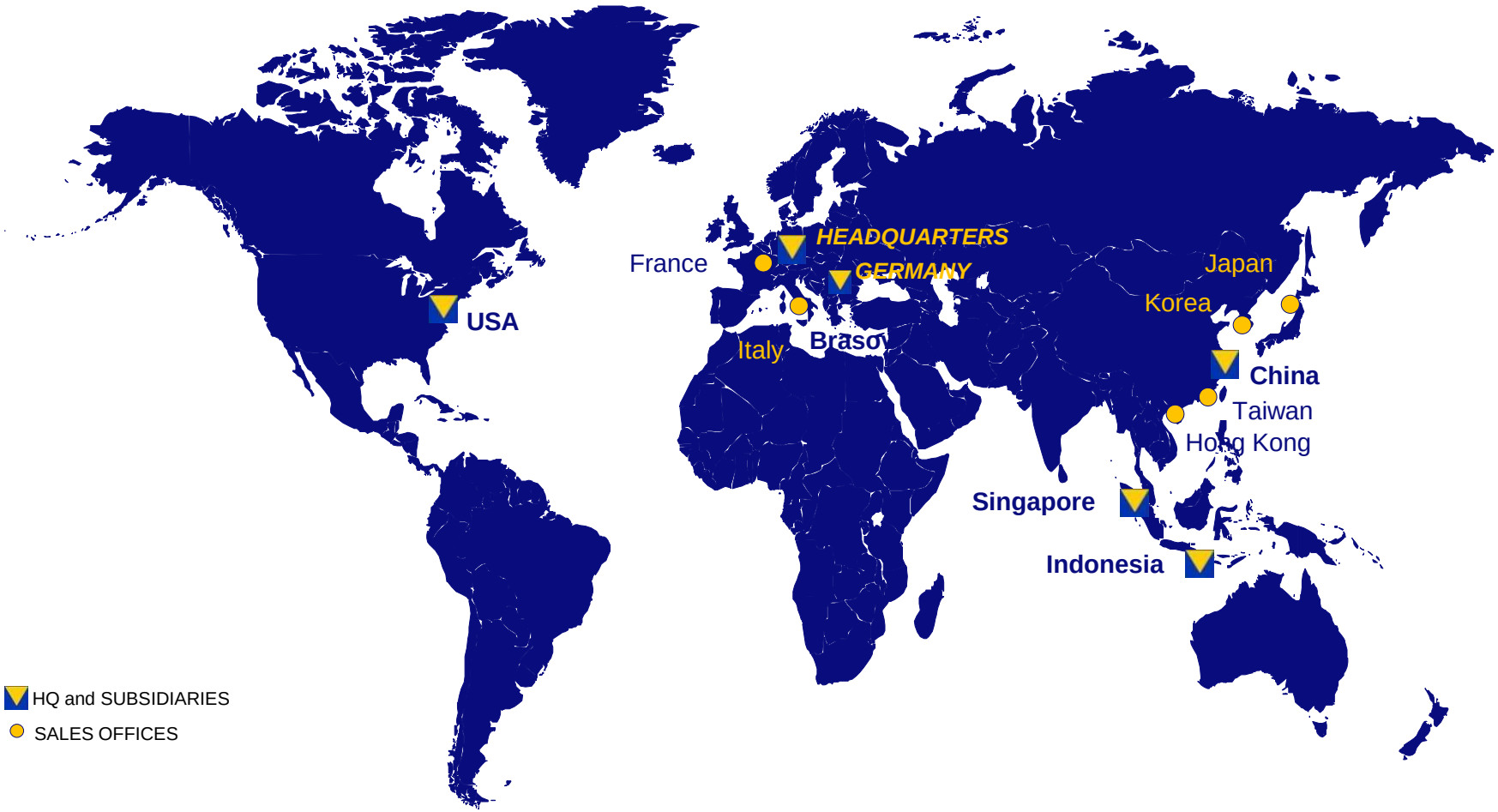
VARTA

Commercial Storage Solutions

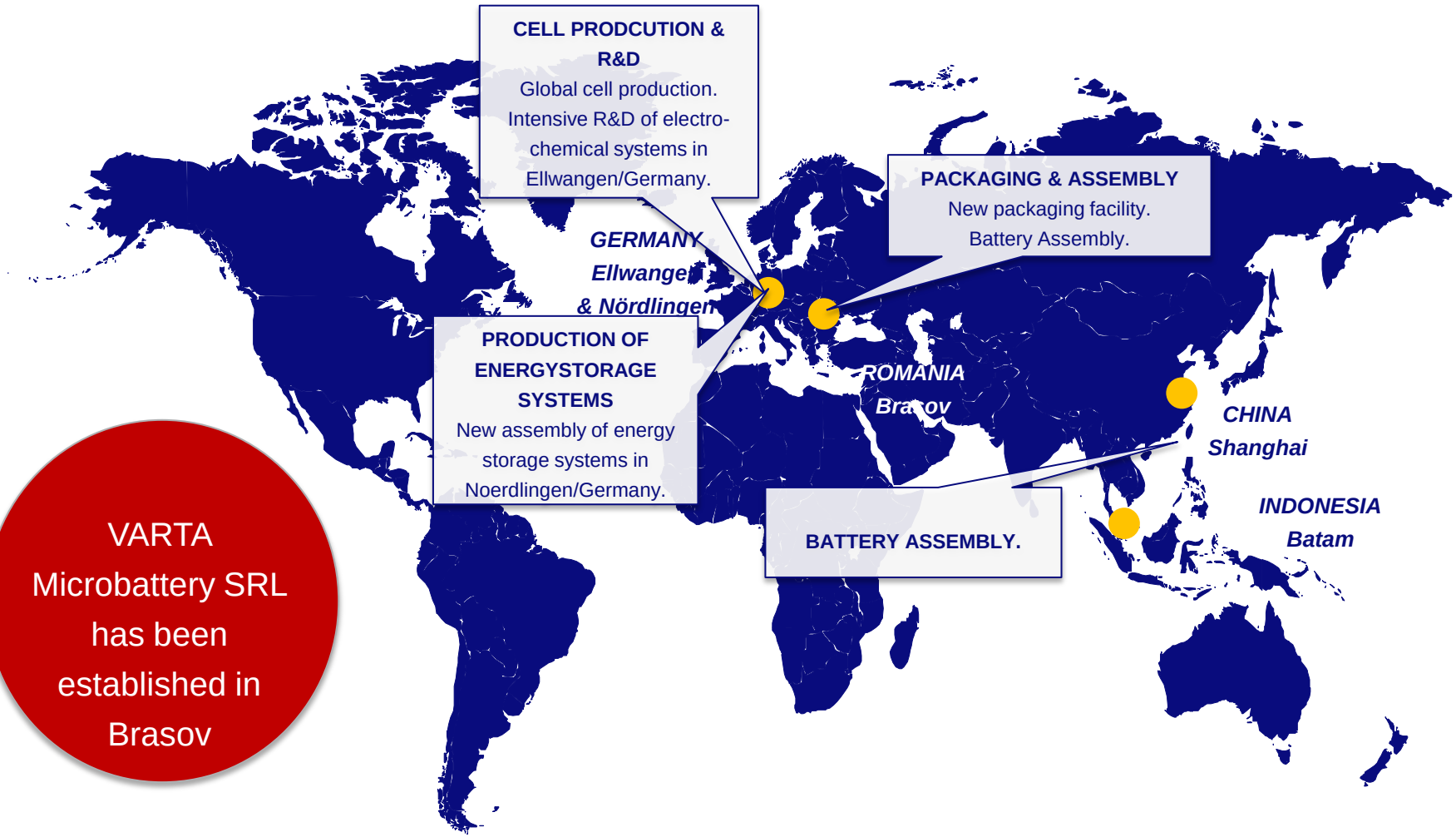
VARTA

VARTA Micro Group

GLOBAL PRESENCE FOR YOUR SERVICE:



VARTA Micro Group



VARTA Microbattery SRL has been established in Brasov

What is a Printed Battery

Printing technology has advantages:

Thin SOA Batteries

Thickness down to 0,6 mm

Separately produced

Mostly by Pick-and-Place-Technology

Design change is very expensive

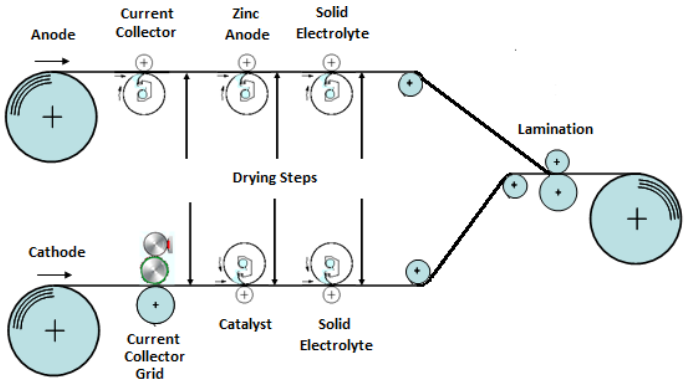
Fully Printed Batteries

ALL components are printed

Design change fast and cheap

Direct printing on Smart Object possible, Printegration

Roll-to-Roll and Sheet-to-Sheet possible



Battery properties – a short Glossar

Cell Voltage
U [V]

Internal DC Resistance
R [Ω, mΩ]

End-of-Charge Voltage
U [V]

Charge „Capacity“
C [Ah, mAh]

Base Current
i [A, mA or C]

Puls Current
i [A, mA or C]

Charge/Discharge Current
i [A, mA or C]

AC Impedance = f(ω)
Z [Ω, mΩ]

End-of-Discharge Voltage
U [V]

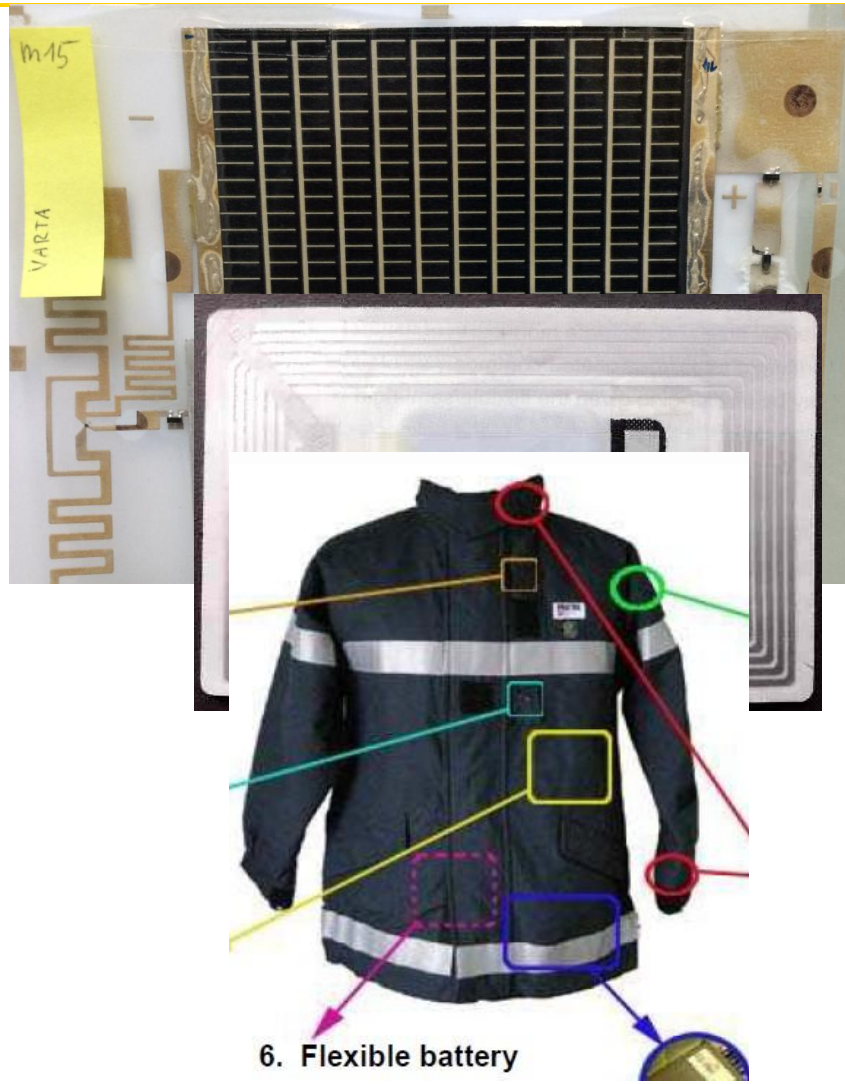
Electrochemical Systems (printability)

Primary		
Zinc/Maganese Dioxide	1,5V	Easy to print, open Systems
Zinc/Air	1,4V	Complicated Cathode, caustic
Zinc/Silver Oxide	1,5V	caustic
Lithium/Mangan. Oxide	3,0V	Sensitive to Water
Secondary		
Nickel/Metal Hydride	1,2V	caustic
Lithium-Ion	3,7V	Sensitive to Water
Organic Radical Battery	??V	Caustic ?

Application of Printed Batteries

Printed Batteries in …

RFID-Labels	**improved distance, Internet of Things IoT**
Sensors	**T-Logger medical sensors Lactate, Pulse frequency Blood sugar**
E-Book	**large Zinc Air Cells**
Gaming	**Game board, Advertisement**
Wearable Technologies	**Smart Textile**



Smart Textile

INTERACTIVE WEAR

Functional Wear

Safety (Police, Fire fighters, Breakdown Service,.)

Leisure Time

Communikation,

Decoration,

Heated Collar

Market:

Small number, high value

Health Care – medical Sensors

Sleep Monitoring, ECG, Puls, Lactate (Sport), Blood sugar(Diabetics)

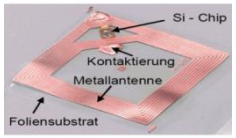
Market: First in the leisure time market, then professional diagnostics,
Health monitoring for elder persons (Pictures by Holst Centre)

Bundesministerium für Bildung und Forschung

VARTA

Logistics

RFID-Tags



RFID HF Transponder

Extended reading distance through active sender

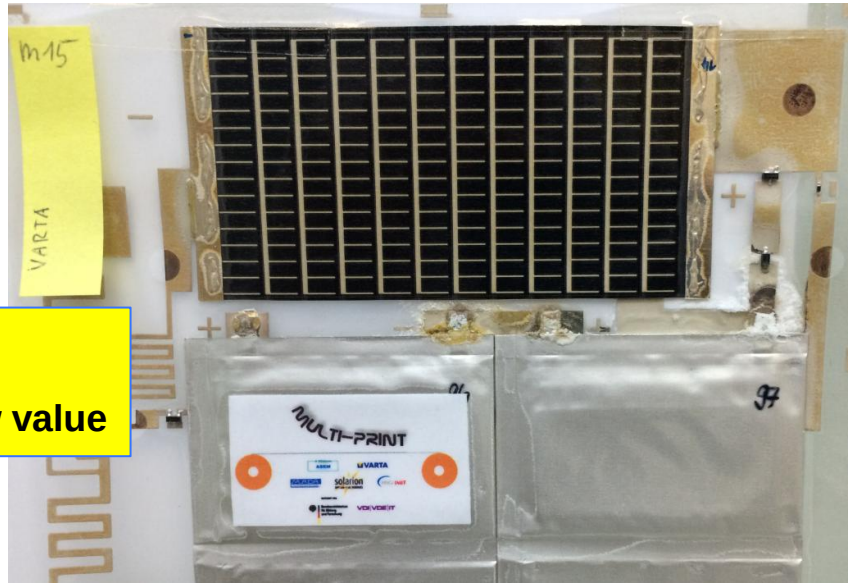
Project: Multiprint (BMBF)

The reading distance was extended by 2x

Market:

Today no request

Market:
High number, low value



Gaming, Smart Book

Functional Game Boards

Children Books

Ravensburger Spiele

Ducky in the Dark, HS München

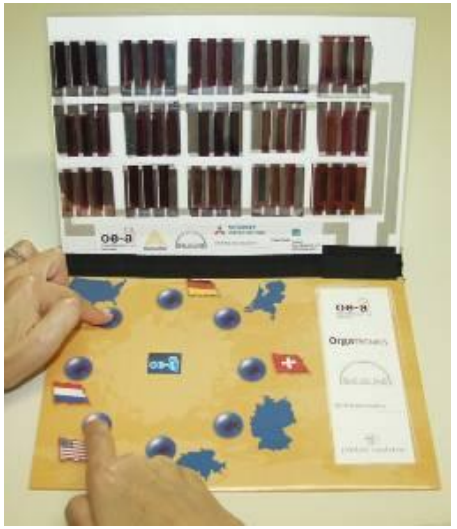
Market:

Market:

Low number, low value

Request low

The customer is content with what they have



Demonstrators by OE-A

Smart Packaging

Packaging with integrated functions

Advertisement at Point-of-Sales

Sales Campaign

Market:

Market:
Low number, low value

Request low

The customer is content with what they have

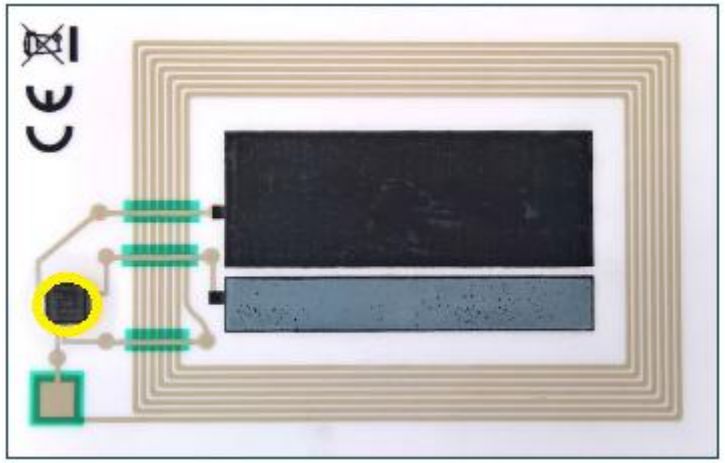
Bombay Saphire

Karl Knauer

T-Logger

Smart Object using:

- Conducting circuit
- Antenna
- Microchip (T-Sensor, T-Logger, NFC)
- Battery, primary Zinc Carbon



T-Logger, Elmeric / VARTA

Application:

Checking of the cold chain

Body temperature

Platform for other sensors

TempTraq, Blue Spark

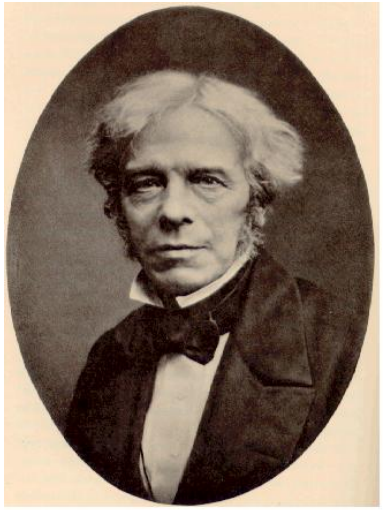
Problem: Not applicable for temperatures <-10°

Optimum Market: Blood Preservation

What influences our work?

Svante August Arrhenius

1859 – 1927



Michael Faraday

1791 – 1867

Gorg Simon Ohm

1787 – 1854

Thanks for your attention