



Wie kommt die Laser-Technik zum Re-Cycling und Re-Use von Li-Ion Batterien?

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Laser Tech | Laser Applikationen

Design | Handling | Robotik

Bilderkennung | Programmierung

Fertigung | Erstproduktion | Installation | Service

Laser Technologie für die Batteriewirtschaft **und mehr**

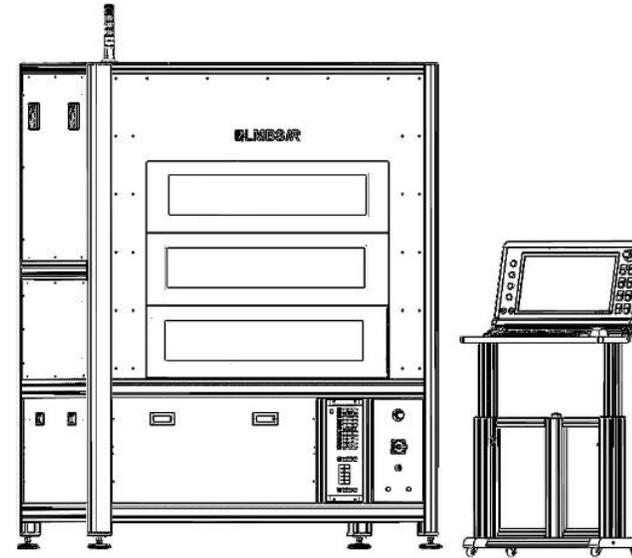


Auf einen Blick

Lasermaterialbearbeitung **AND** Sondermaschinenbau
Wir machen die unmöglichste Applikation möglich
1st of its kind & kleine Serien

Industrien

Batterien
Pharma
Halbleiter
Automotive
Metallbearbeitung
Verpackung / Luxus



Material

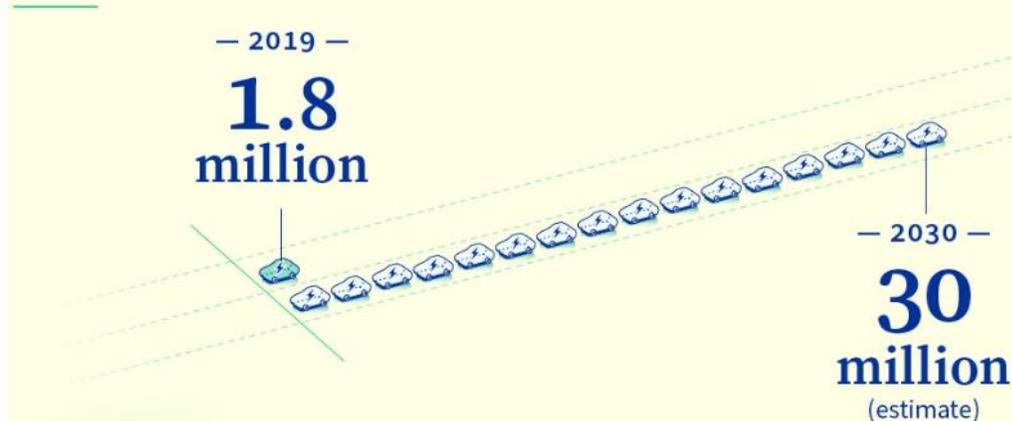
Metall
Glas
Kunststoff
Keramik
Silizium
Diamanten

Situation: Ein großer Boom - "ohne uns"



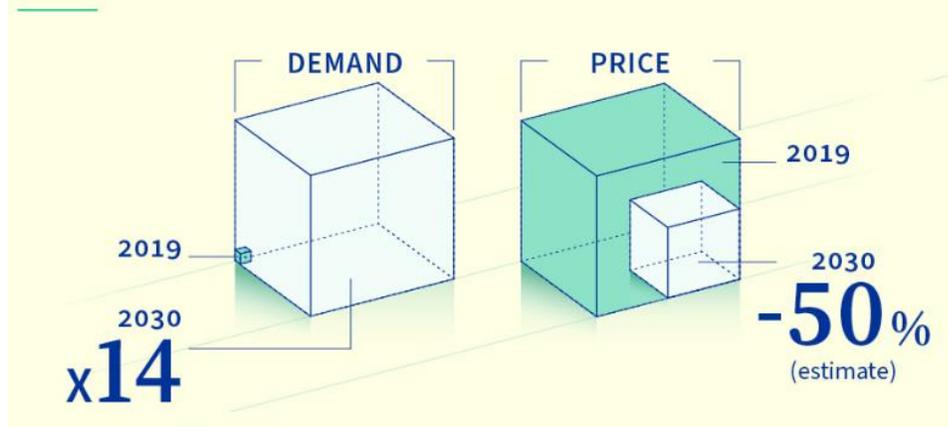
Electric vehicles on the road

Battery electric vehicles (BEVs) and plug-in hybrid electric vehicles



Global demand and price for batteries

Including domestic batteries



Problem im Re-cycling, Re-manufacturing und Re-use



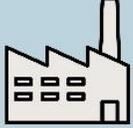
- Recycling zerstört wertvolle Ressourcen und erzeugt Sondermüll
- Recycling ist Handarbeit und sehr gefährlich: **Keine** Skalierung
- **Kein** Angebot für Re-manufacturing
- **Kein** Angebot für Re-use
- **Keine** Technologie
- Brand-new Gesetze, die sehr ambitioniert sind
- Verglichen mit Asien: Haben wir “nur”
 - Neue Anbieter
 - Kleine Anbieter
 - Deutsche Gründlichkeit

Production

Mining, Refining and Mixing

Cobalt
Nickel
Manganese
Lithium
Others

Battery Material Production

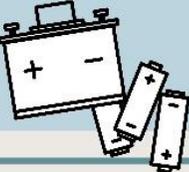


Cell Manufacturing

- | | | |
|--------------------------------|--------------------------|--------------------------|
| Electrode Manufacturing | Cell Assembly | Formation / Aging |
| - Mixing | - Cutting | - Formation |
| - Coating | - Stacking, Winding | - Degassing |
| - Calendering | - Assembly of components | - Aging |
| - Drying | - Electrolyte Filling | - EOL Testing |

Battery System Assembly

- | | | |
|------------------------|------------------------|---------------------------------|
| Module Assembly | System Assembly | Handling & Logistics |
| | - BMS, Housing | |
| | - Cooling | |
| | System Test | |



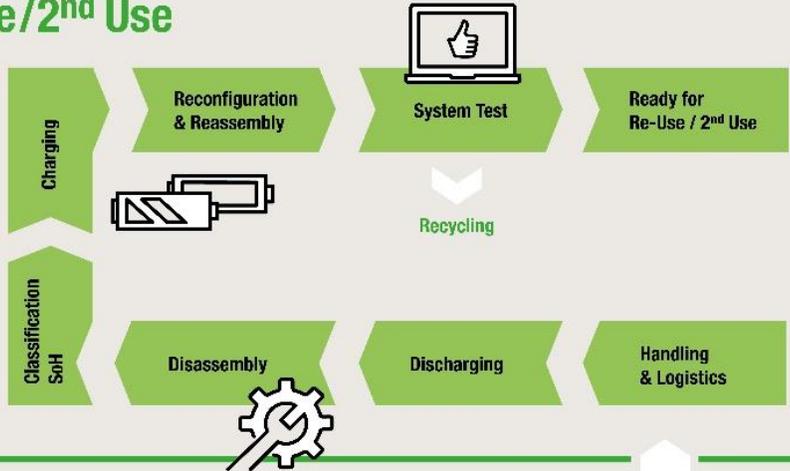
Production Waste
30% Recycling

Recycling

Recovery cathode & anode materials

Cobalt
Nickel
Manganese
Lithium
Iron
Graphite
Others

Re-Use/2nd Use



Integration in Applications



Operation Service



Operation / Use

Recycling

Classification

Energetic Treatment

Separation / Fractionation

- | | |
|---------------------------|-----------------------------|
| Chemical | Mechanical |
| - Leaching | - Shock wave disintegration |
| - Solvent Extraction | - Shredding |
| - Electrochemical Winning | - Scraping |



Preparation for Recycling

- | | |
|--------------------|-------------------------|
| Disassembly | Deep Discharging |
| - Manually | - Electricity |
| - Automated | - Water |



Handling & Logistics



Handling & Logistics

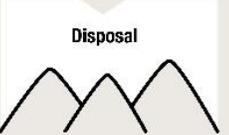


Dismount



SoH-Testing / BMS Diagnostics

Disposal



Mining, Refining and Mixing

Cobalt
Nickel
Manganese
Lithium
Others

Battery Material Production



Cell Manufacturing

Electrode Manufacturing

- Mixing
- Coating
- Calendering
- Drying

Cell Assembly

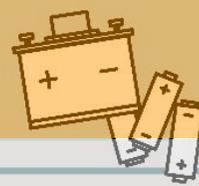
- Cutting
- Stacking, Winding
- Assembly of components
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Formation / Aging

- Formation
- Degassing
- Aging
- EOL Testing

Battery System Assembly

Module Assembly



System Assembly

- BMS, Housing
- Cooling

System Test

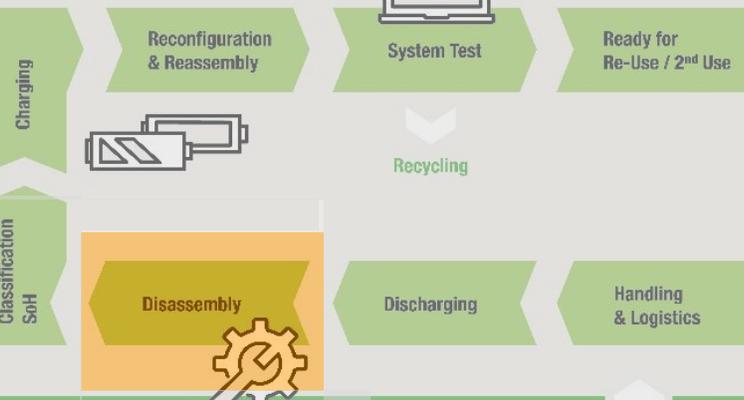
Handling & Logistics



Production Waste
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Recycling

Re-Use/2nd Use



Operation / Use

Recycling

Classification

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Chemical

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Preparation for Recycling

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- Manually
- Automated

Deep Discharging

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- Water



Handling & Logistics



Handling & Logistics



Dismount



SoH-Testing / BMS Diagnostics



Disposal



• Unsere Batterieindustrie ist nicht wettbewerbsfähig mit Asien

Lösung: Laser Tech in Sondermaschinen



Laser

- Schnell wie Licht
- Höchste Präzision
- Kein Verschleiß
- Complette neue Anwendungen



Sicherheit

- Erkennen
- Reagieren
- Integriert

Automatisierung

- Immer reproduzierbar und sicher
- Hohe Geschwindigkeit
- Handling
- Bilderkennung
- Programmierung
- All-in-one system

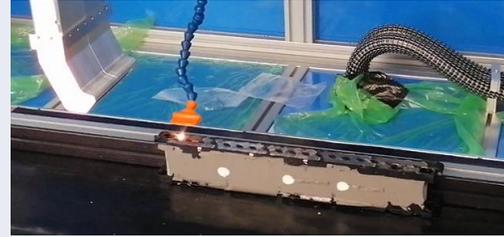
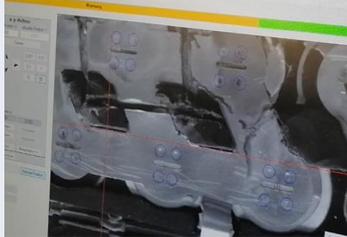


Lösung: Laser Tech in Sondermaschinen



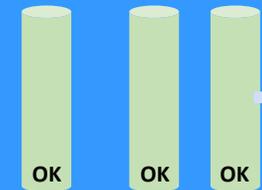
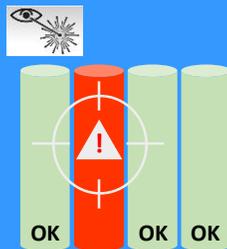
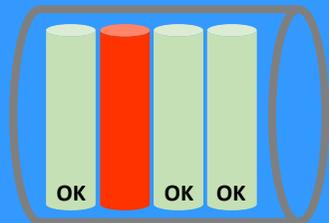
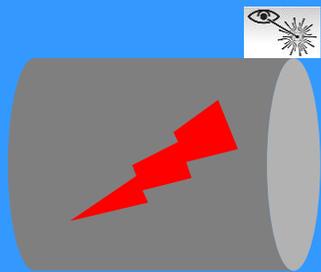
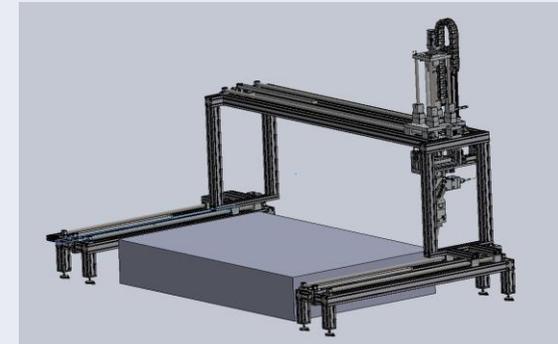
Öffnen von Batteriemodulen (Recycling/Re-Use)

- Herstellerunabhängig
- Gehäuse öffnen
- Wiedergewinnen der einzelnen Zelle
- Sicherheit



Öffnen von Batteriesystemen (Recycling/Re-Use)

- Prozess vor dem Schreddern
- Herstellerunabhängig
- 4,5m x 3m x 4m
- vollautomatisch
- 3D Laserprozess
- Materialien
 - Metall (bis 1cm)
 - Kunststoff
 - Klebstoff
- Sicherheit



Frage an das Publikum



- Wir lieben unseren Ansatz..
- Aber, wir möchten von Ihrer Perspektive lernen
- **Was fehlt um die beste zirkuläre Batteriewirtschaft zu bauen?**

Vielen Dank!

Lassen Sie uns in Kontakt bleiben



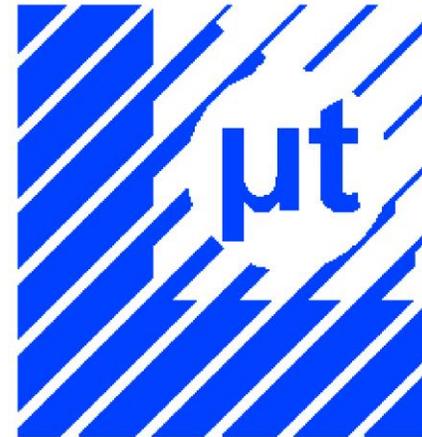
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