

Ultra-Light Weight PEC... and Chemistry/Purity Information

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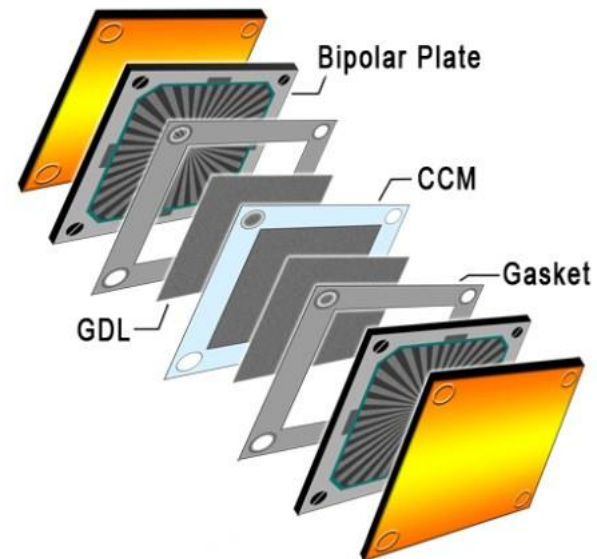
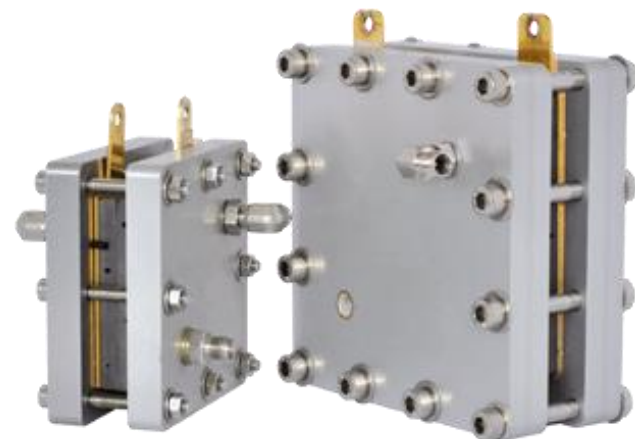
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ULW PEC Device/System

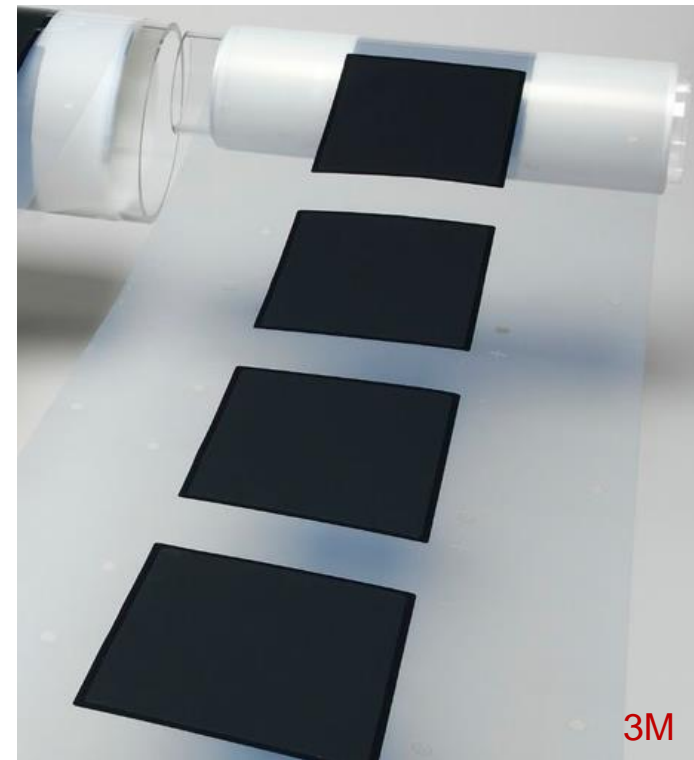
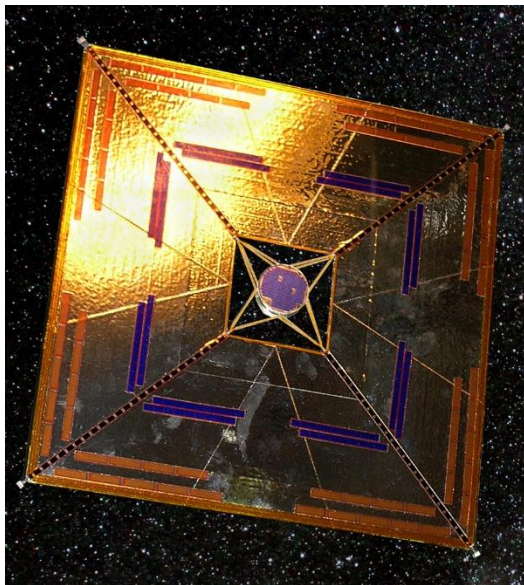
- Design
 - Photon Management
- Deployment
- Metrics (W/kg, kg/m²)
- System Scaling
- Filter (chemical inputs/outputs)





ULW PEC Device/System

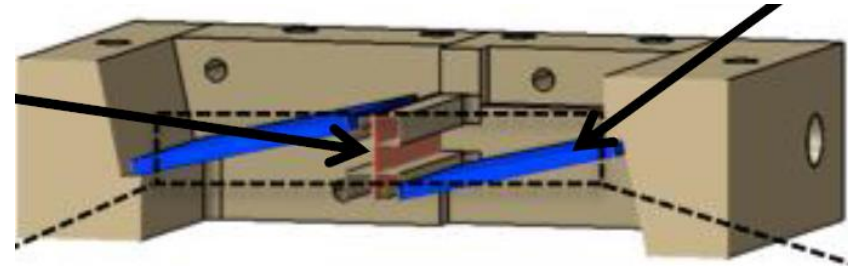
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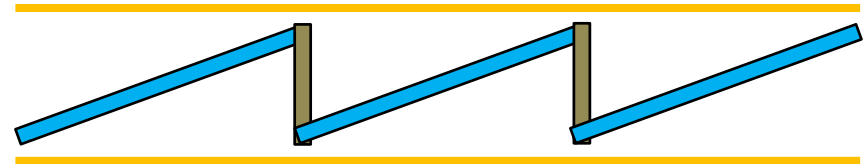


ULW PEC Considerations

- Transport dry/empty and fill on Mars
- Roll out material
- Autonomously
 - Adopts flat geometry
 - Creates volume for electrolyte
- Less structural support required, due to 1/3 g
 - **What does that look like?**

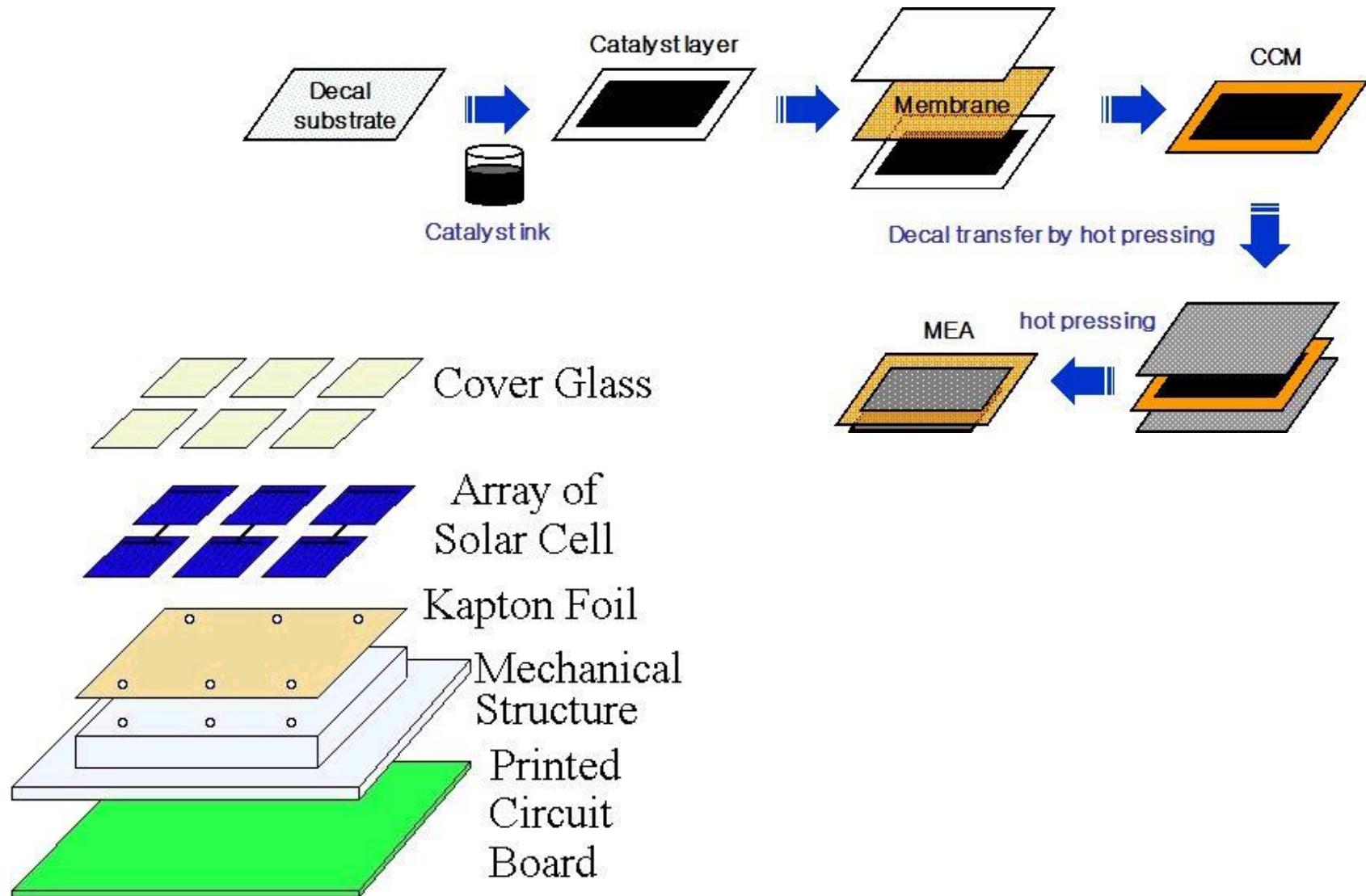


- Vapor vs. Liquid (Water) Feed?
 - **Liquid:** Failures due to gravity
 - **Vapor:** Failures due to pressure, but aspect ratio can alleviate this
- Compressor is "free" mass (scroll pump from MOXIE)
 - **Reactants:** CO₂, water (vapor)
 - **Products:** O₂, CO (or other)
- **Can the device handle temperature cycles/swings (esp. Nafion)?**





ULW PEC Device/System





Cell/Module Bill of Materials

Nearly everything "cost" $\sim 1 \text{ g/m}^2$ per μm thick = 1 g/mL

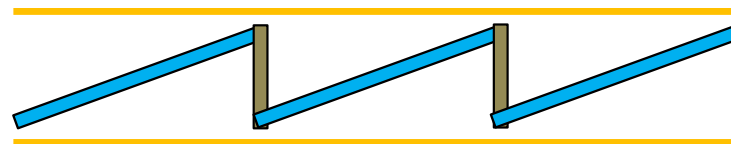
- Containment (x2)
 - Gorilla Glass (25 μm) 60 g/m^2
 - or HDPE (75 μm) 75 g/m^2
 - %T = 95, leak rate = $45 \text{ g H}_2/\text{m}^2/\text{year}$ (3.5% of H_2 produced)^[i]

- PV (*assume $\eta_{STH} = 10\%$ at 1 Sun on Earth*)
 - PV Materials and Contacts 20 g/m^2
 - Kapton Support (15 μm) 15 g/m^2

- MEA
 - Catalysts (2 mg/cm^2) 20 g/m^2
 - C Fiber (25 μm) 25 g/m^2
 - Nafion (50 μm) 50 g/m^2
 - C Fiber (25 μm) 25 g/m^2
 - Catalysts (2 mg/cm^2) 20 g/m^2

+ 20% for structural support
+ x% for pipes, control system, etc.

One person's propellant requires
 $\sim 1000 \text{ m}^2$, which here equates to
a $(370 + y) \text{ kg}$ payload (< 0.5 mt!)



[i] Directed Technologies, Inc., DOE Report, 2009 & Pinaud, ..., Ardo, ..., Jaramillo, *Energy Environ. Sci.*, 2013, 6, 1983