Structural Concepts for lightweight and cost effective end plates for fuel cell stacks

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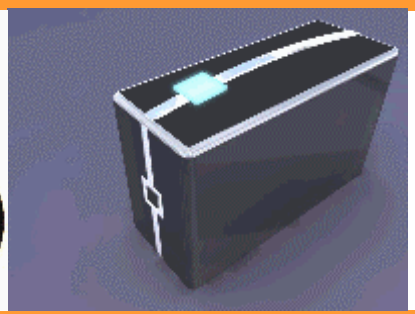
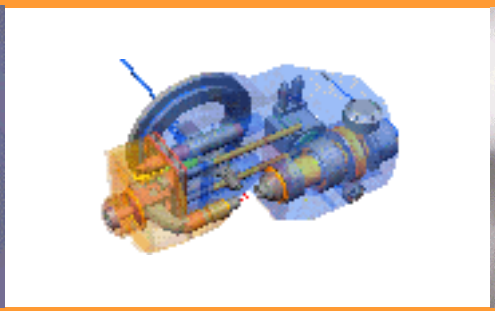

conception - design - engineering

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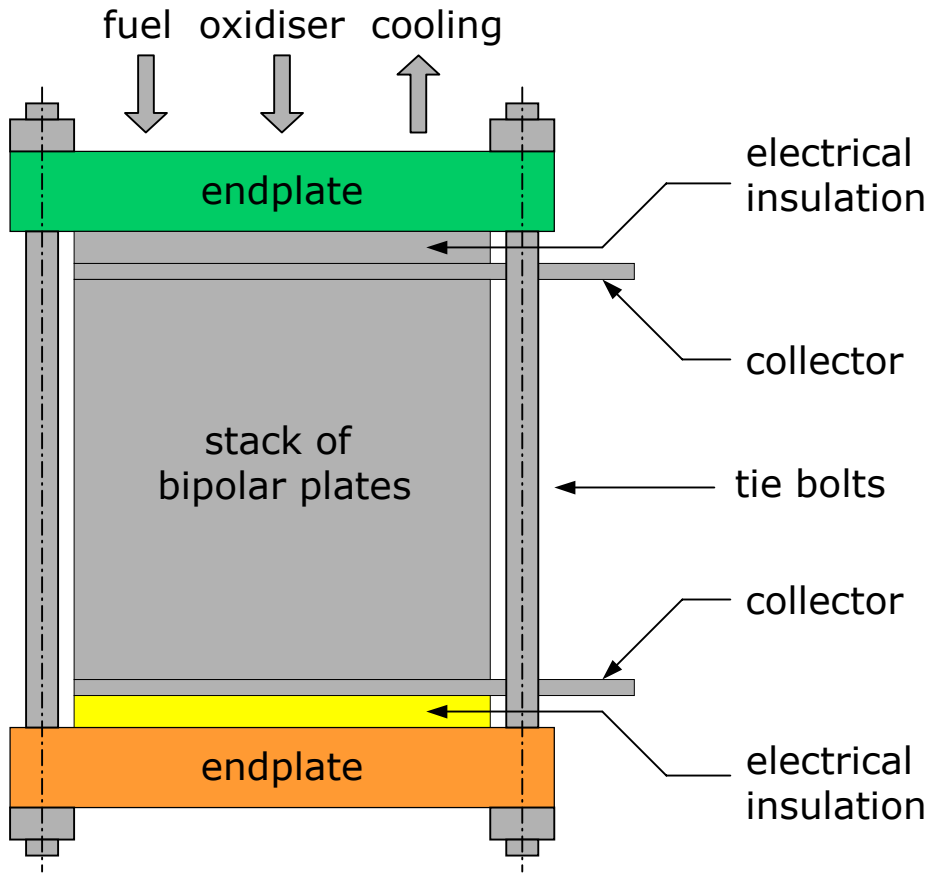
The fuel cell stack - structural view

A fully mounted fuel cell stack (PEMFC)

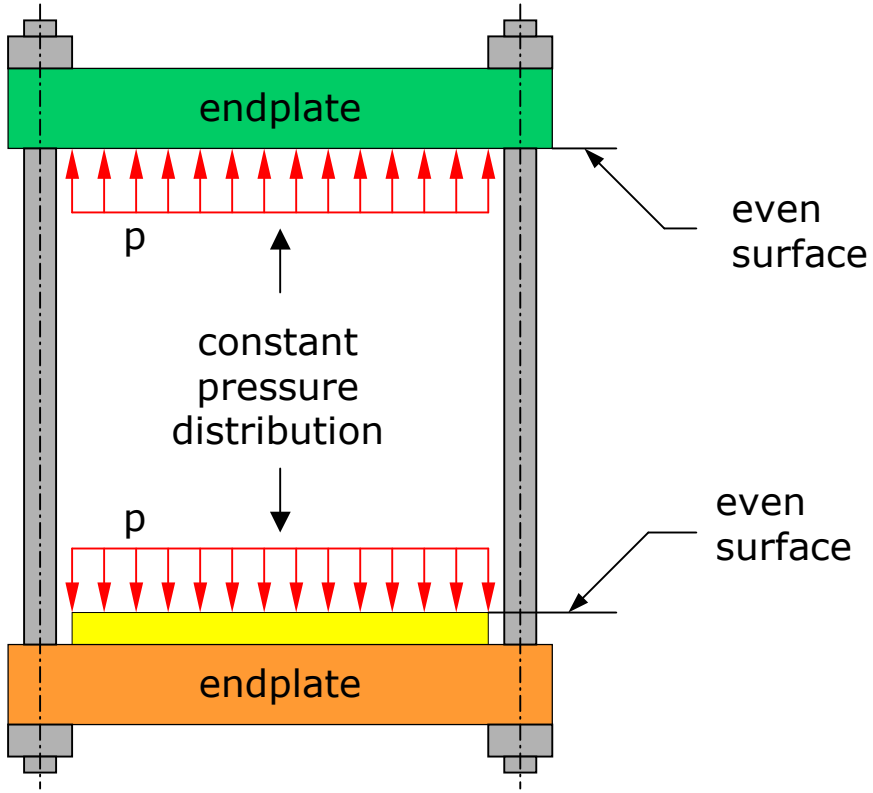
- Tie bolts under tension (force F)
- Stack pressure acting on the end plate (pressure p)



The fuel cell stack - a structural view

Remove the bipolar stack and one electrical insulation

- add stack pressure acting on the endplate
- contact surface has to be even !



The fuel cell stack - a structural view

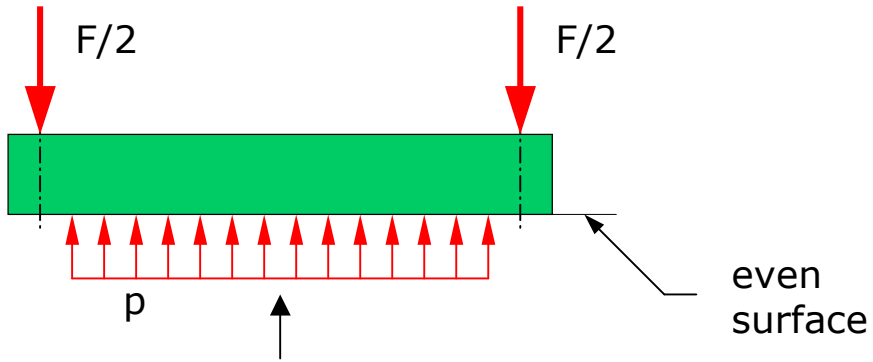
Remove the tie bolts

- add tie bolt force acting on the endplate

Two approaches can be found:

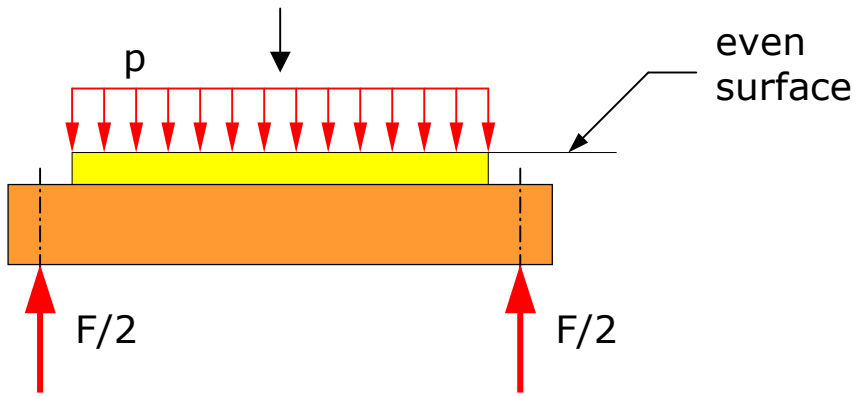
Classical approach

- One part



New approach

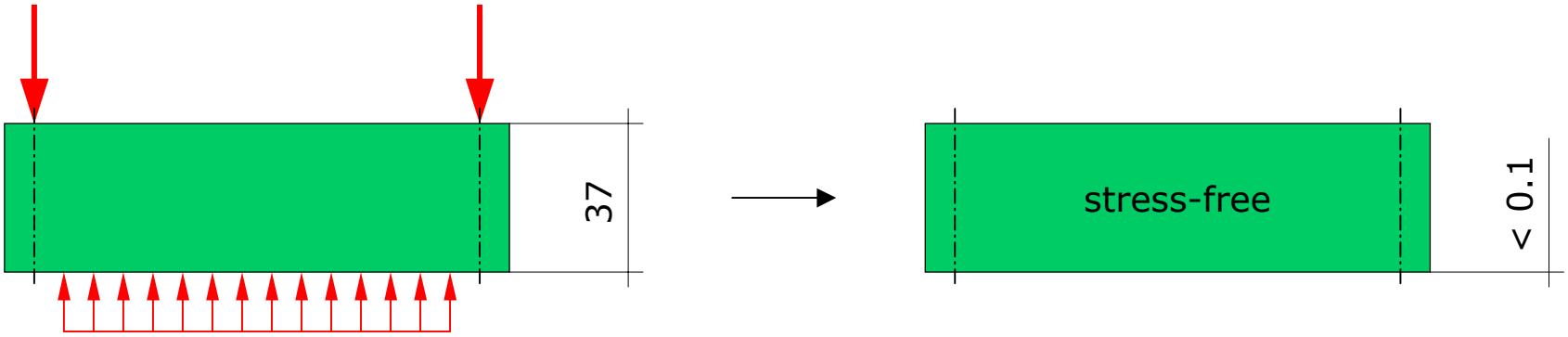
- Two parts !



The end plate - classical approach

Example 1: thick solid endplate (190 x 150 x 37 mm)

- Under stress-free conditions the plate is still even (<0.1 mm).



Typical application:

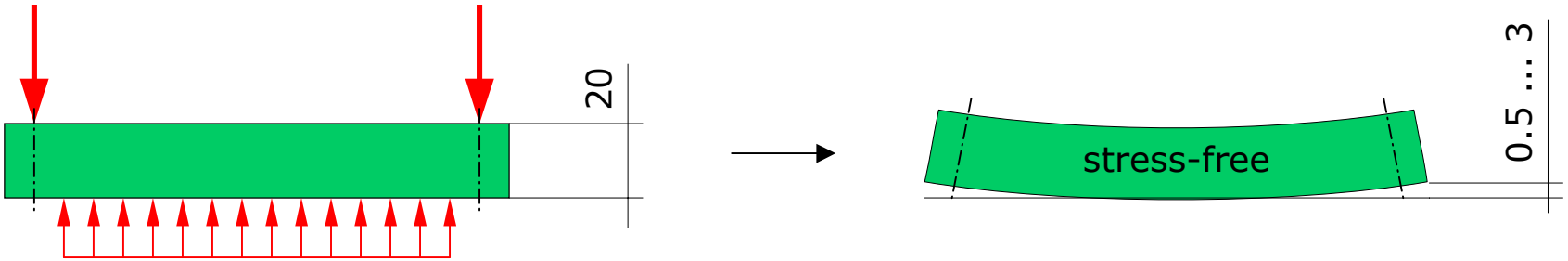
- laboratory
- proof of concept for the electrochemical process

Drawback:

- too expensive for series production (waste of material)
- too heavy for mobile applications

Example 2: thin solid endplate (20 mm)

- Under stress-free conditions the plates deformation cannot be neglected (0.5 … 3).



Bomb shaping:

- gap compensates deformation

Typical application:

- prototypes for mobile systems

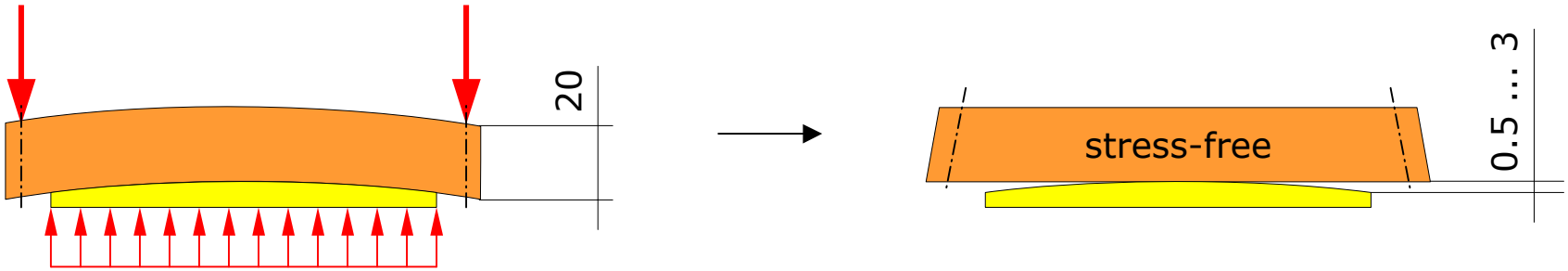
Drawback:

- high strength material
- expensive manufacturing process

Design for Hy.Power project

Example 3: thin solid endplate (20 mm)

- Under stress-free conditions the plates deformation cannot be neglected (0.5 … 3).



Bomb shaping

Typical application:

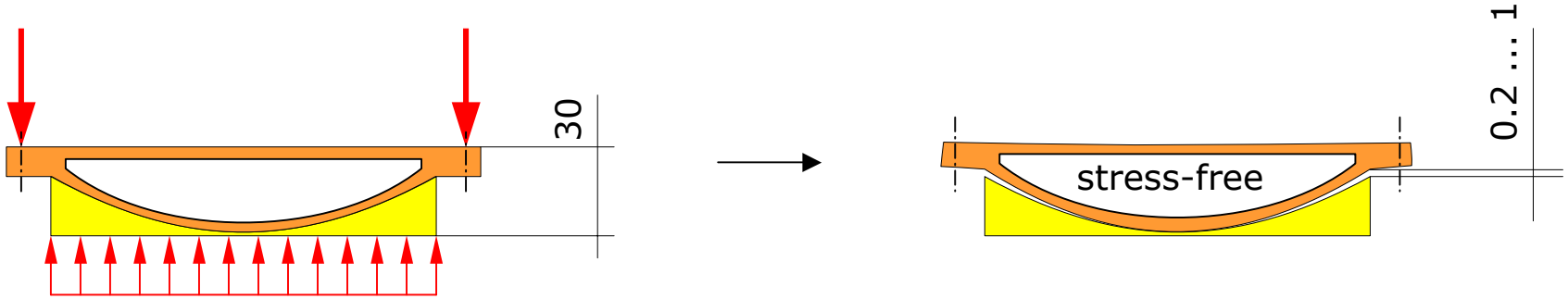
- prototypes for mobile systems

Drawback:

- high strength material
- expensive manufacturing of *two* parts !

Example 4: electrical insulation becomes important

- Under stress-free conditions the plates deformation is below 1 mm.



Bomb shaping

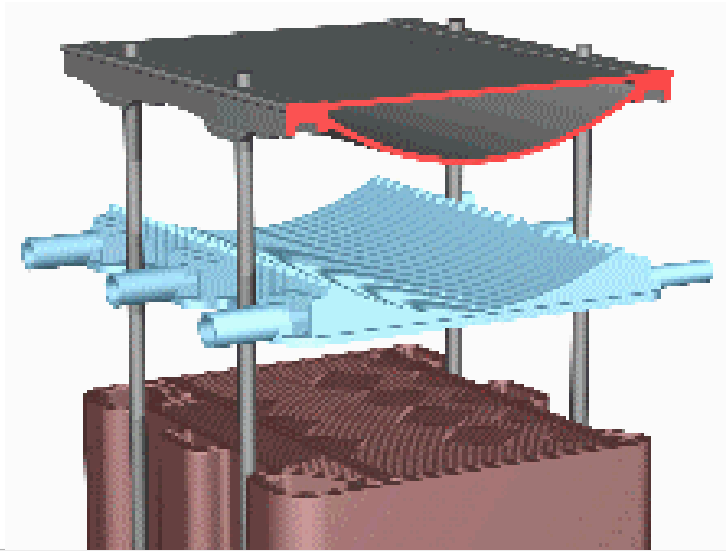
Typical application:

- series for mobile and stationary application
- ultra light weight fuel cell stacks

Drawback:

- higher cost for prototyping

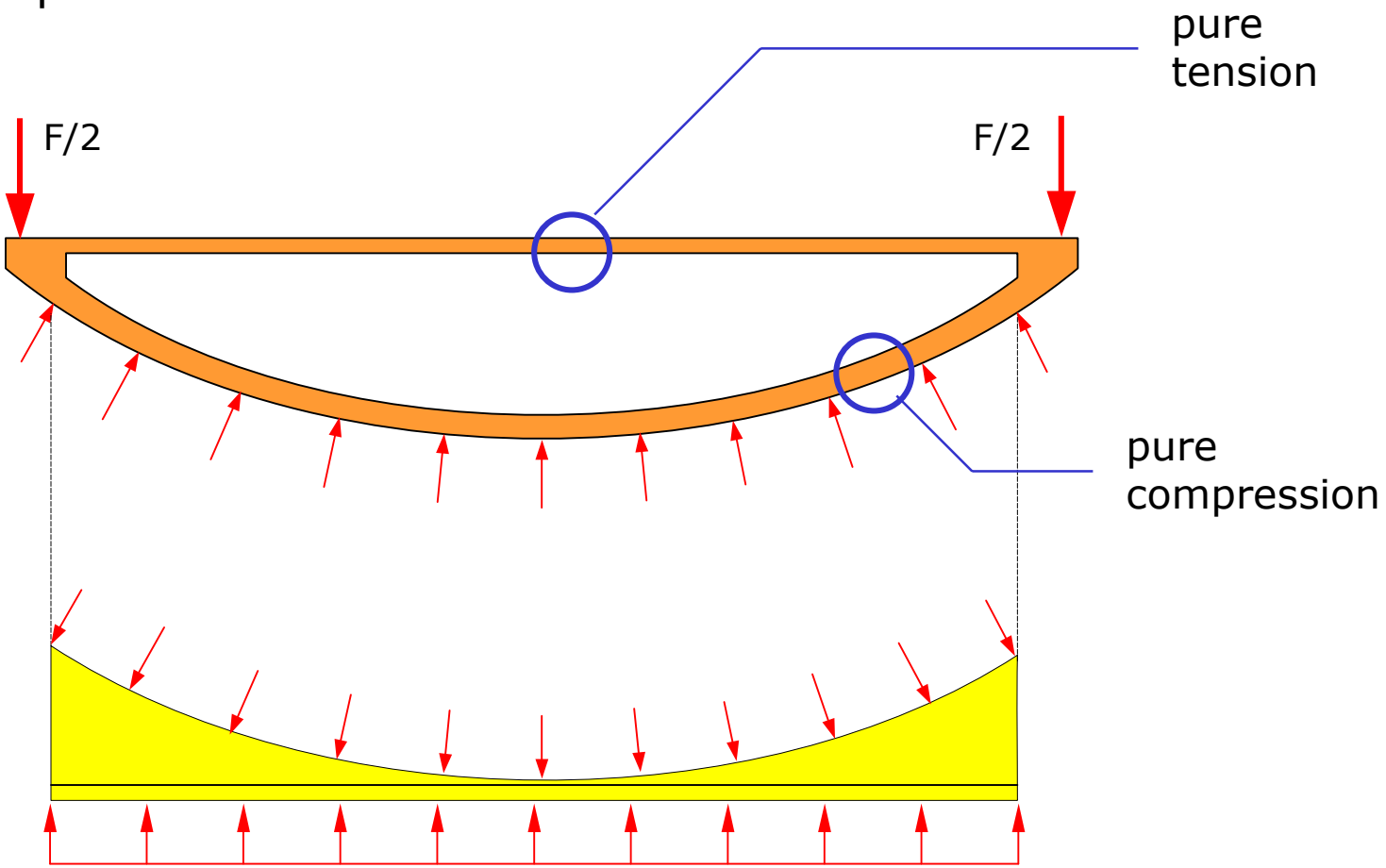
Design for PowerPac



D.bow - a new concept for fuel cell end plates

The D.bow end plate consists of two parts

- Pressure plate
- Media plate

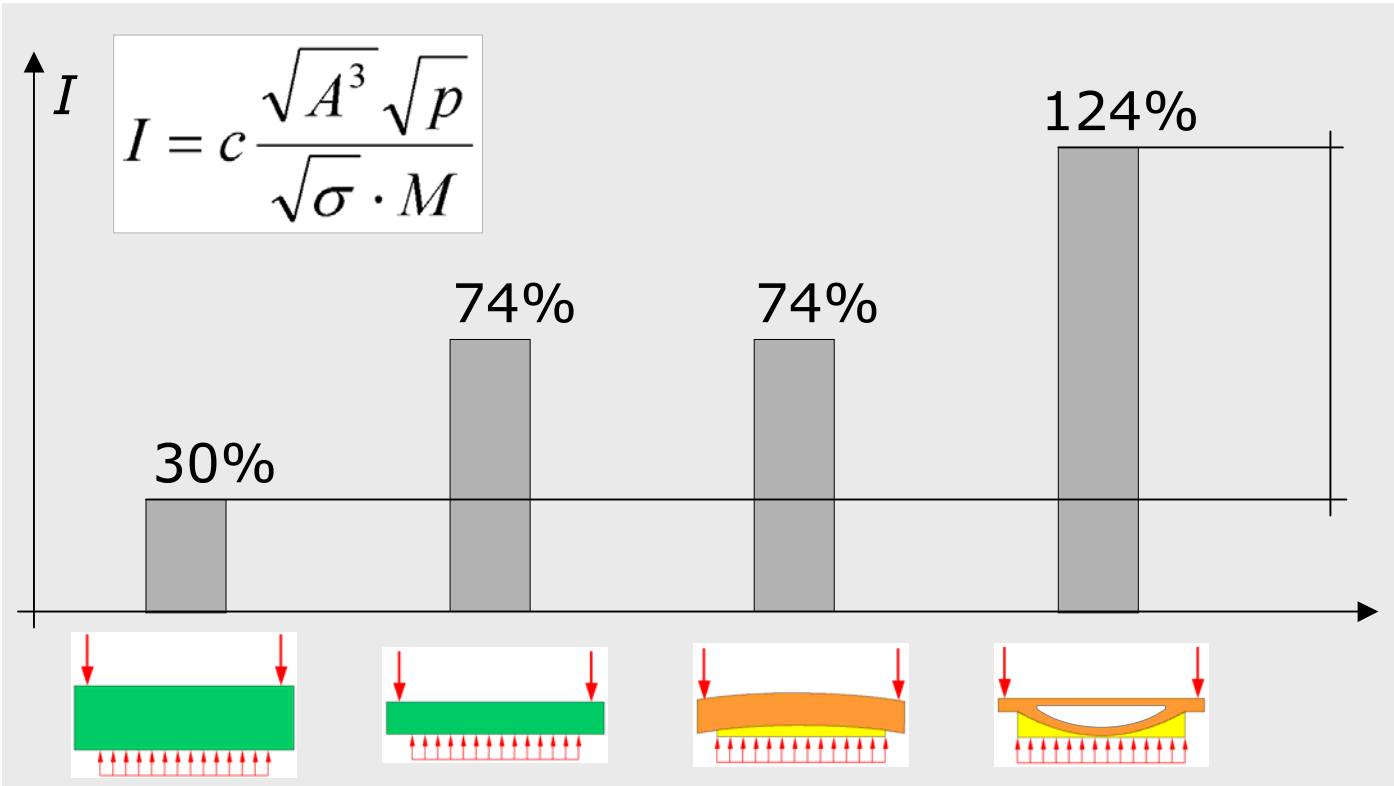


Performance Index *I*

Introduction of performance Index taking into account

- stack cross section, pressure, material strength and mass

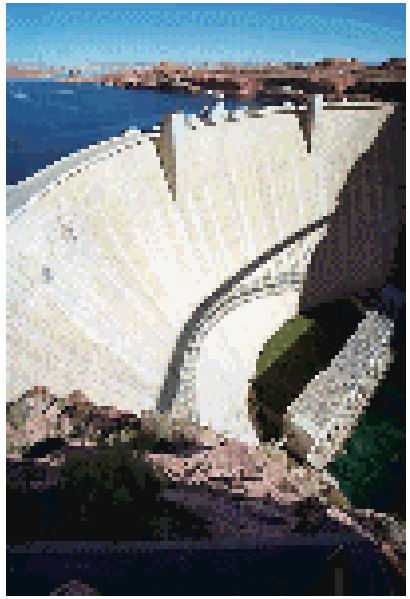
I is a quantitative measure to compare endplate concepts



Properties of new endplate concept: D.bow

Fuel cell stack

- no impact on the electrochemical process
- rectangular, cornered & tubular FC
- Minimised loss of specific power



Endplate

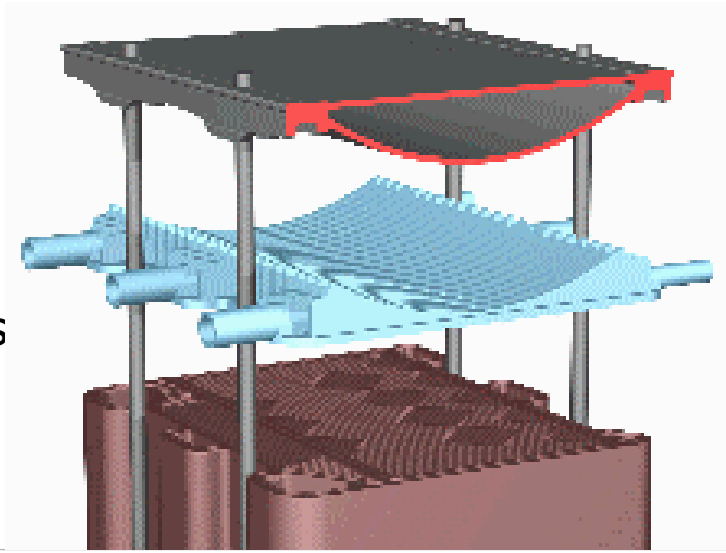
- optimised material distribution
- lightweight
- low cost

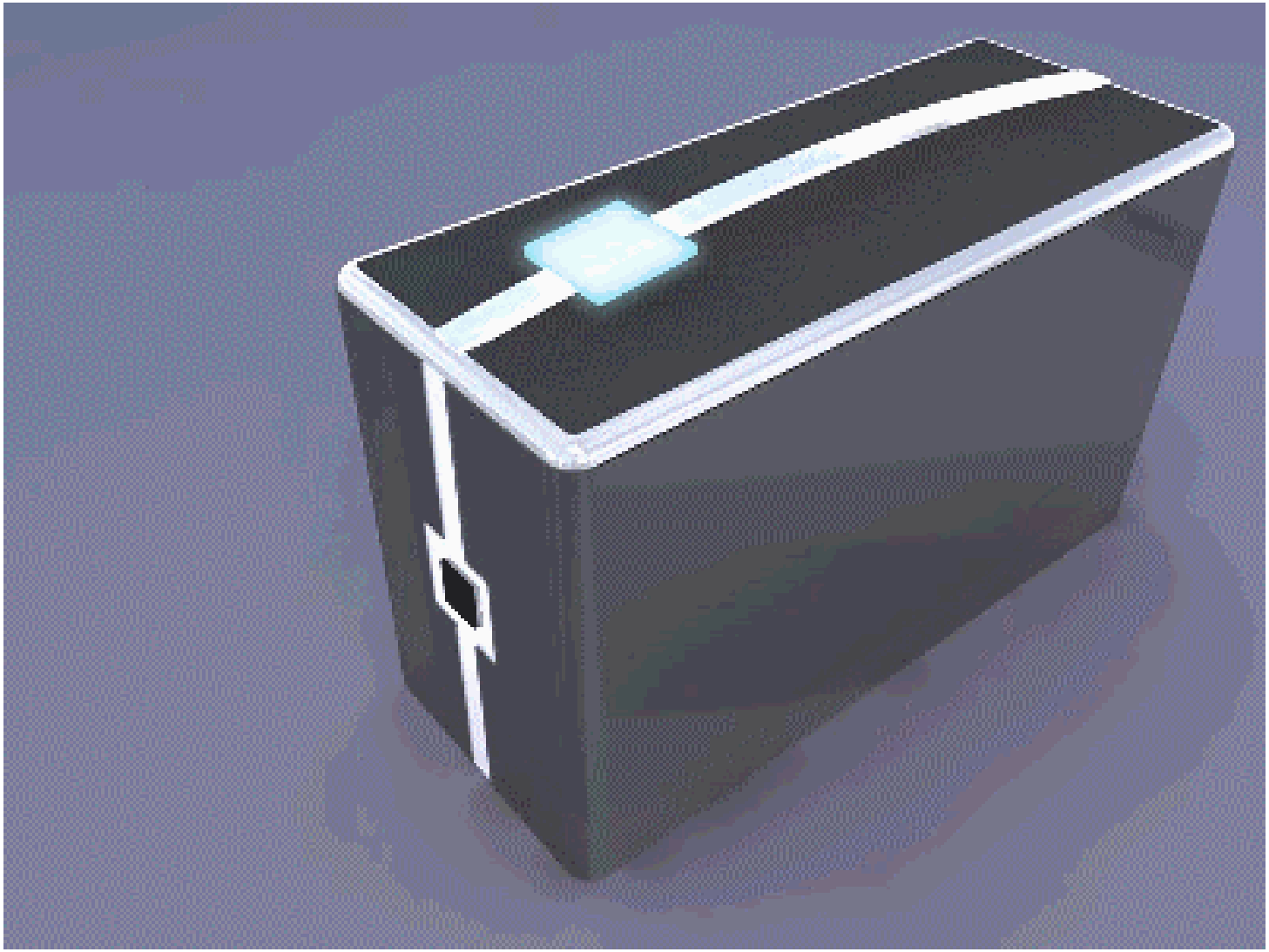
Pressure plate

- Extrusion profiling, aluminium
- Medium strength sufficient

Media plate

- injection moulding, thermoplastics
- Media supply line included

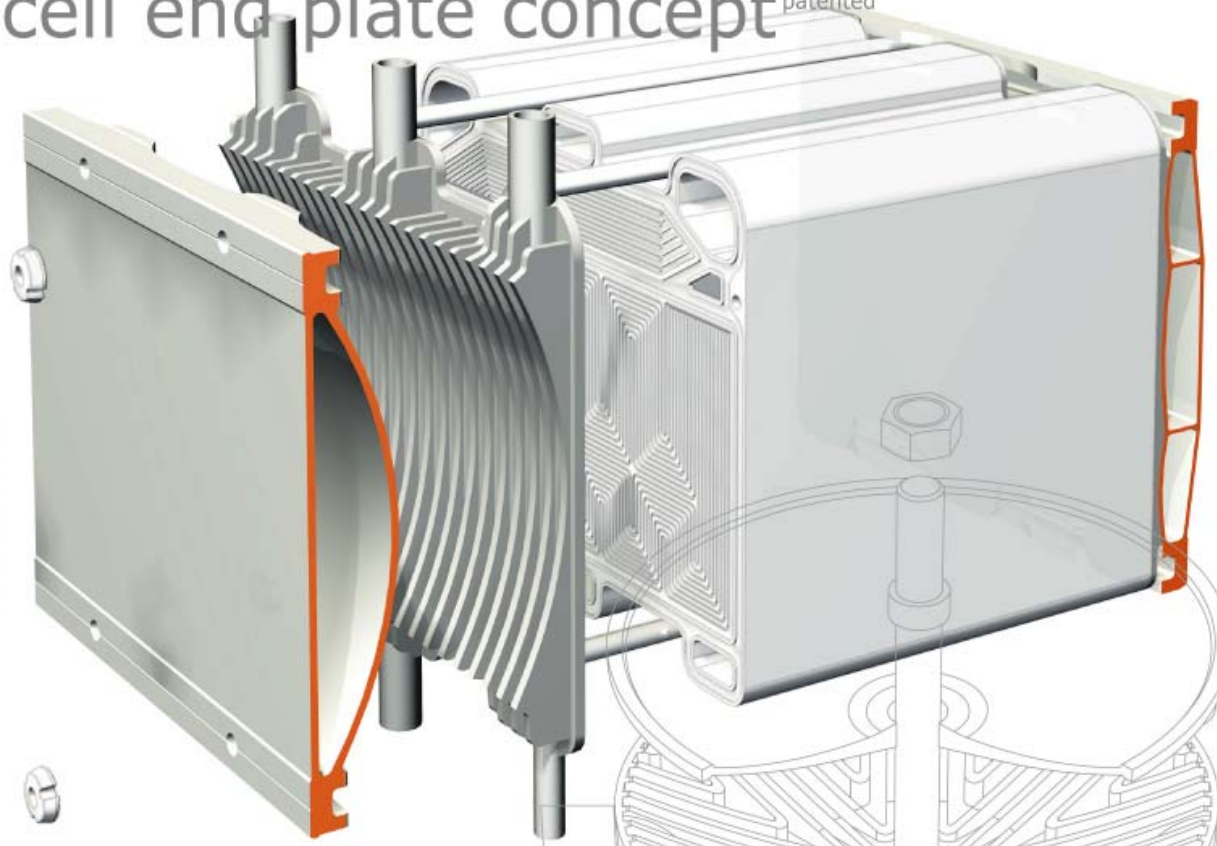




D.bow

fuel cell end plate concept patented

high performance
low cost
minimum weight



D.bow adapts to any stack geometry

developed by TRIBECRAFT
konzeption design engineering