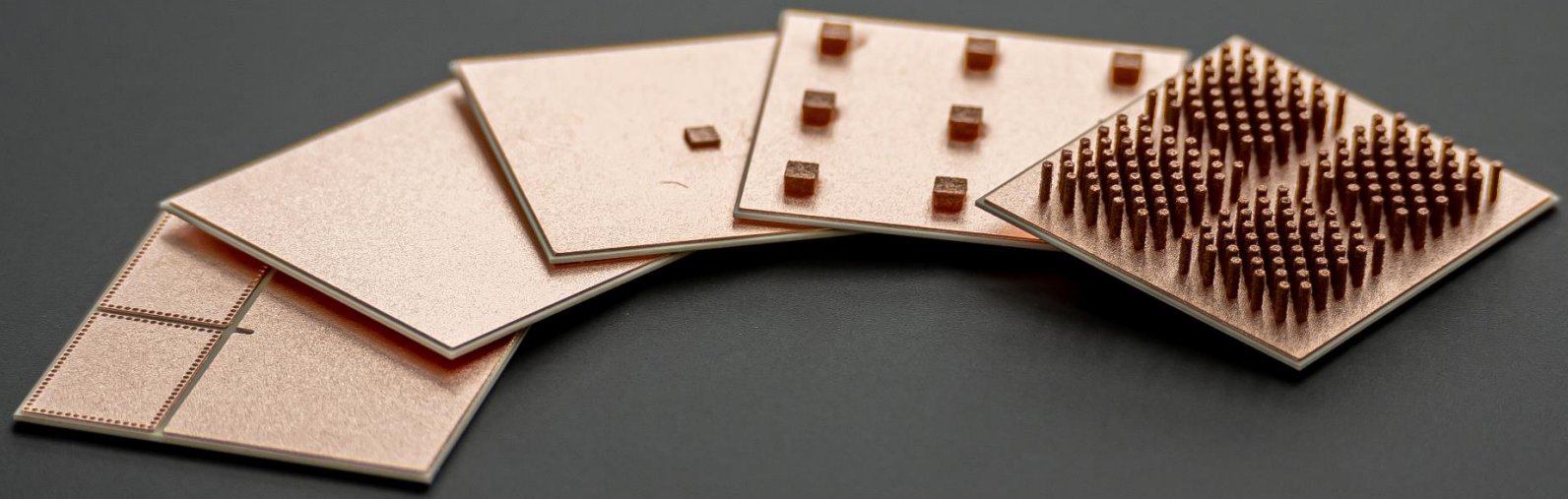
# GlobalAM

## Enabling Laser Powder Bed Fusion for Large Scale Production of Multi-Material Components



Funded by the European Union under grant agreement no. 101138289. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Health and Digital Executive Agency (HADEA) (granting authority). Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union

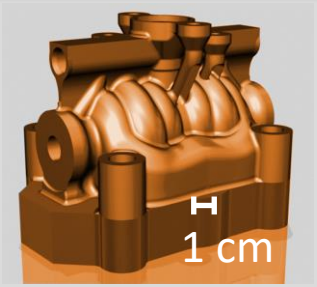
7.5.2024

# Vision

Metal laser powder bed fusion (LPBF-M) of metals is an established manufacturing technique with great potential in terms of flexibility, digitalization, geometric freedom.
**But:** Productivity of LPBF-M is still too low to penetrate mass markets.

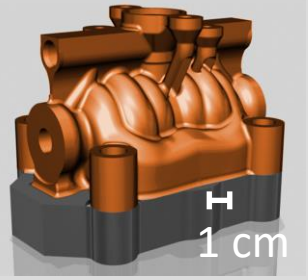
**GlobalAM approach:** Focus additive manufacturing on (small) functional elements

## *Classical AM*



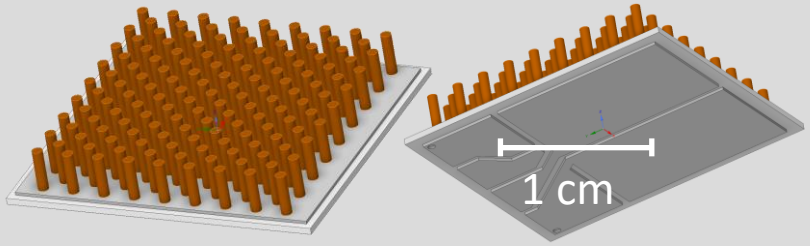

Printing massive components
→ Focus: metal on metal substrate
→ Cyc
→ Cos
→ No

## *Hybrid AM*




Hybrid printing of massive component
→ Focus: metal on metal inlay
→ Cy
→ Cos
→ Fit t

## *Feature Based Hybrid AM*




Printing *tiny features*
→ Cycle time: ~ s ↓
→ Powder demand ↓
→ Cost-benefit ratio ↑

**LPBF-M fits mass manufacturing e.g for electronic components.**


Funded by the European Union

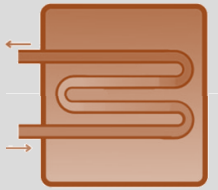
# Mission

**GlobalAM aims to unlock** the potential of **additive manufacturing for large scale production** by **feature based hybrid production on dissimilar substrate materials.**

## Key Exploitable Results:

**advanced machine concept** for highly reduced cycle times + precision positioning of substrates

**superior material systems** for defect-free products with improved functional performance



competitive **high performance cooling device** as industrialization demonstrator

## Project Key Facts:

**8**
Project partners

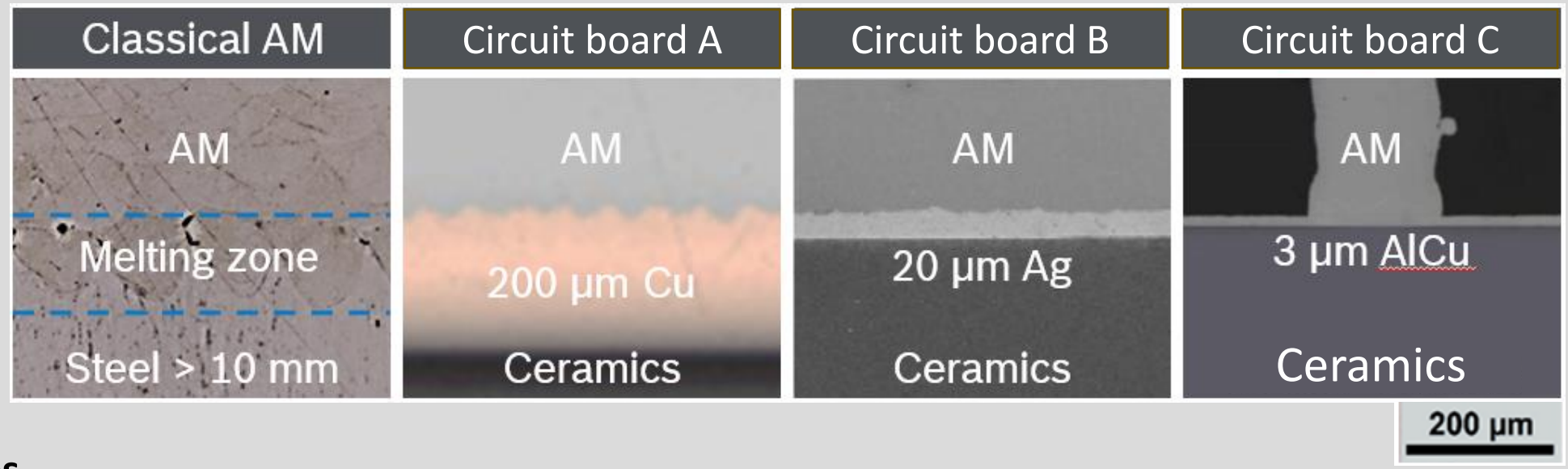
**36 months**
Project duration

**Jan. 1st 2024**
Starting date

**4.0 Mio. €**
Budget

# Process Challenges

Mastering **Multi-Material AM on Fragile Substrates**




**Challenges**

(1) Multi-material systems: substrate + metalization + AM part

(2) Strictly limited melting zone: < metalization thickness

(3) Substrates vulnerable to cracks → low residual stress process

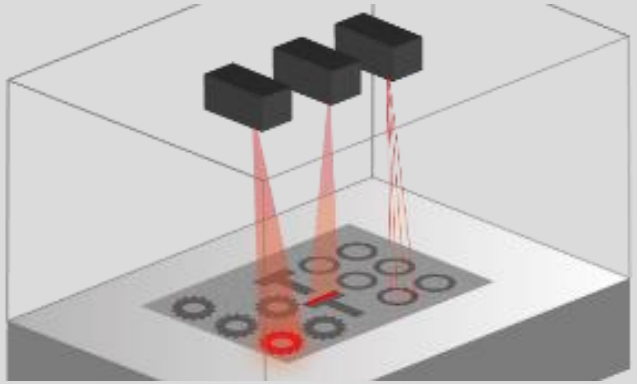
***Solutions***

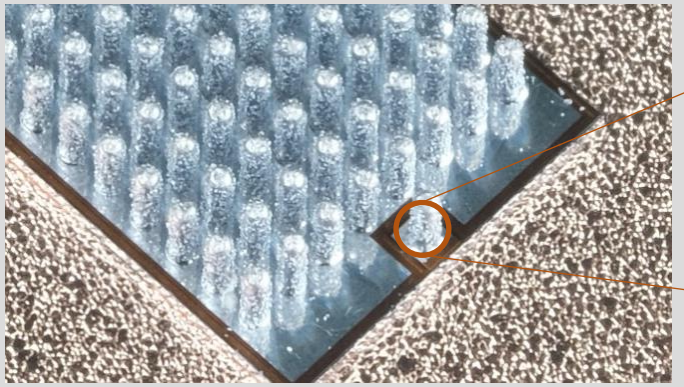
Simulation-supported process development
Adapted process strategies

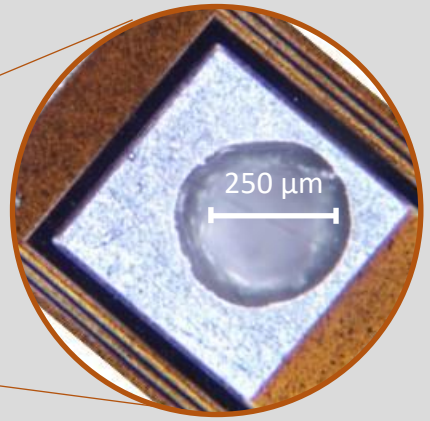

Funded by the European Union

# Machinery Challenges

Mastering **Productivity, Precision & Automation**








**Challenges**

(1) High productivity & cost efficiency

→ Short AM cycle times (< 5 min / batch ≙ s / part),…

(2) Highly precise adjustment of laser(s) vs. substrate

→ Positional accuracy < 50 µm

(3) Full line integration

automated loading and depowdering

***Solutions***

- Laser beam shaping & splitting
- In-line process monitoring and defect compensation
- Substrate fixation & positioning system

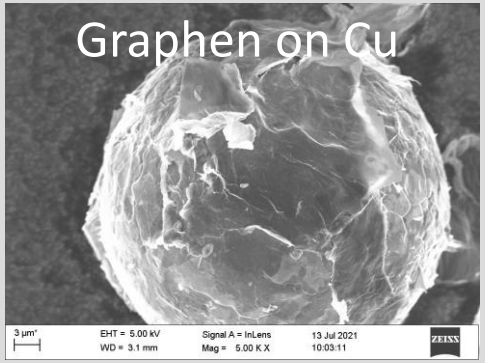


Funded by the European Union

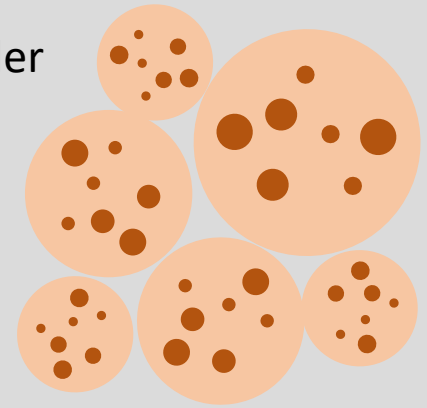
# Materials Challenges

Mastering **Functional Properties, Aging, Scalability**

core-shell powder




metal matrix powder



**Challenges**

(1) Reliably joining of dissimilar materials

→ life time requirements for automotive applications

(2) Best functional properties

→ high flowability/absorption/conductivity, low aging, …

(3) Recycling of powder

→ mass production scale powder recycling for economic and environmental compatibility

***Solutions***

- core shell powders
- metal matrix composites
- non-standard materials


Funded by the European Union

# Key Enabling Technologies

**Key Enabling Technologies** employed + **responsible partners** to achieve project goals:

**Process & Defect Monitoring**

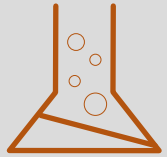
POLITECNICO MILANO 1863 · BOSCH

**Substrate Fixation**

Prima Additive

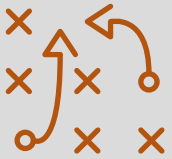
**Beam Shaping & Splitting**

Prima Additive · BOSCH



**Multi-material Powders**

AMAZEMET · SAFINA



**Substrate Positioning**

Prima Additive

**Multi-scale Modelling**

DTU Technical University of Denmark

**In-line Defect Compensation**

POLITECNICO MILANO 1863 · BOSCH

**High Resolution Residual Stress Analysis**

UNIKASSEL VERSITÄT



Funded by the European Union

# Project Partners

https://www.bosch.de/

http://www.uni-kassel.de/uni/

https://www.eura-ag.com/en/

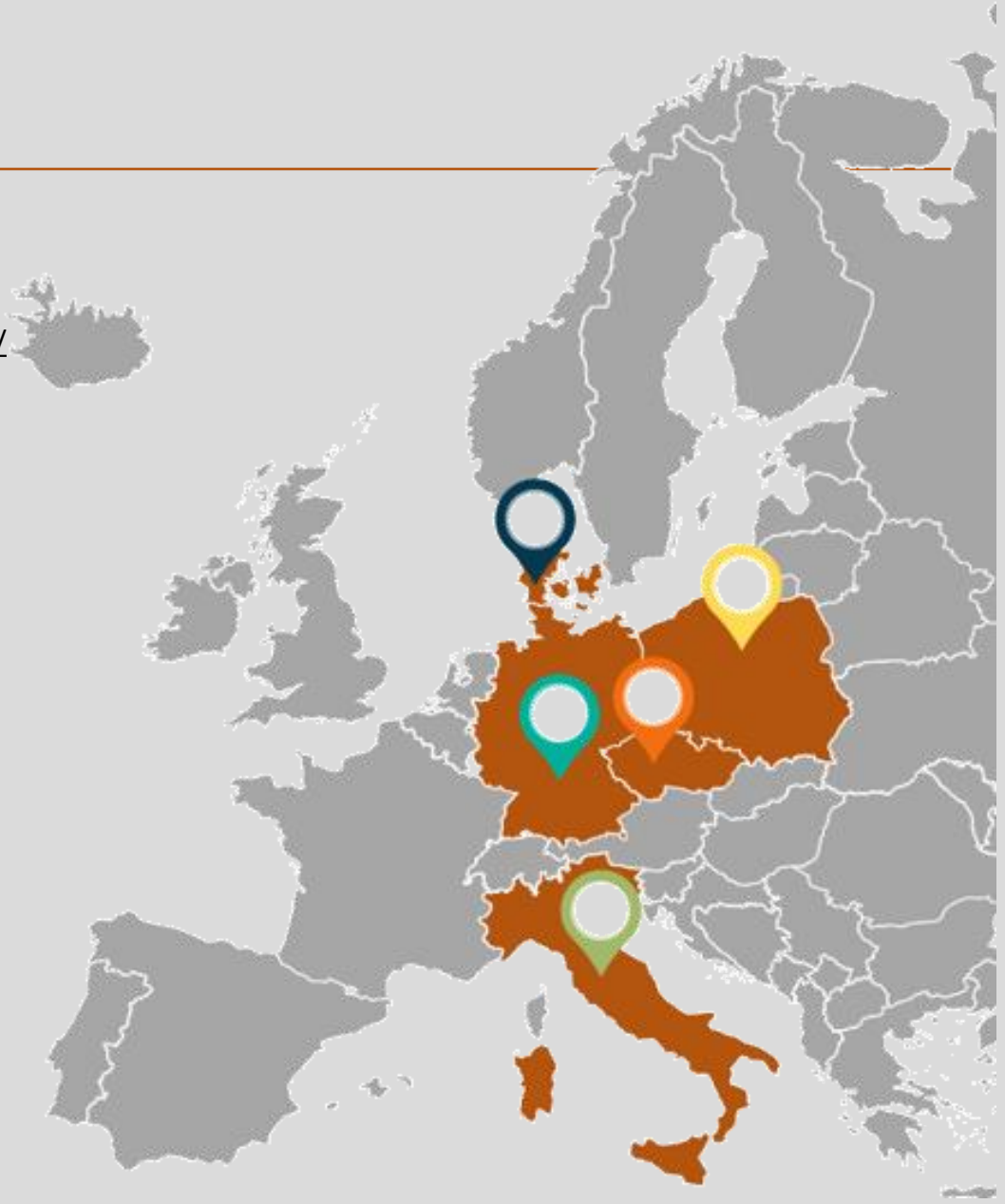
https://www.primaadditive.com/en

http://www.polimi.it/

http://www.dtu.dk/english

http://www.safina.cz/

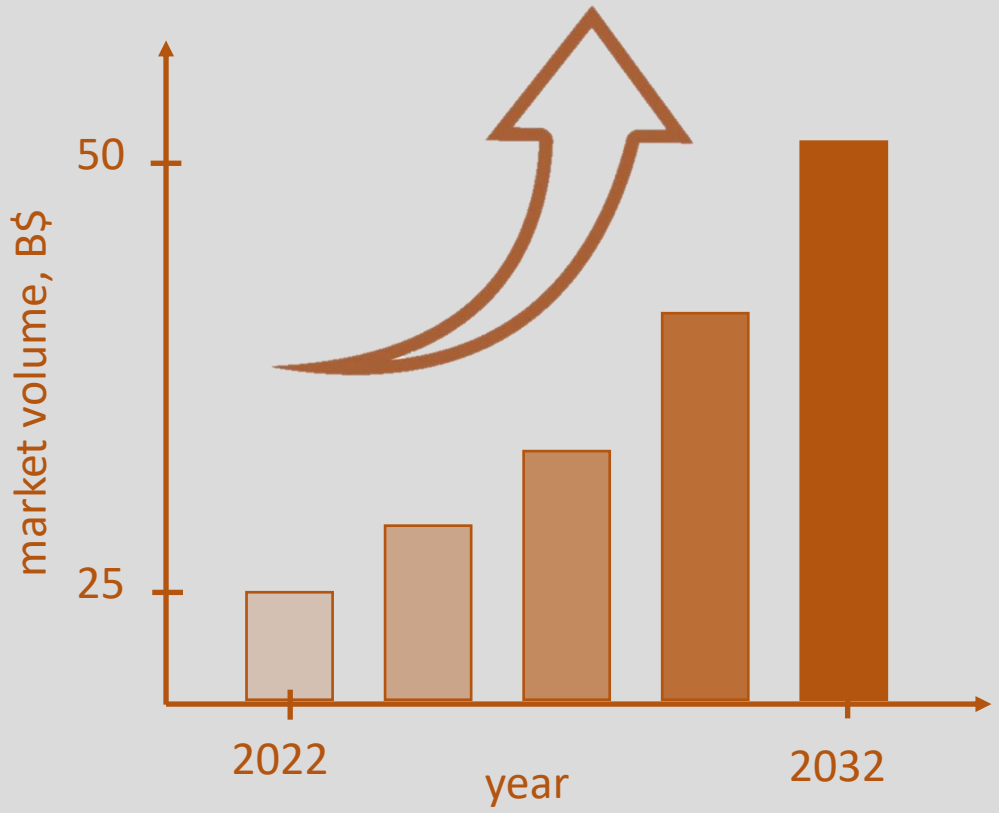
http://www.amazemet.com/





Funded by the European Union

# Inverter Market



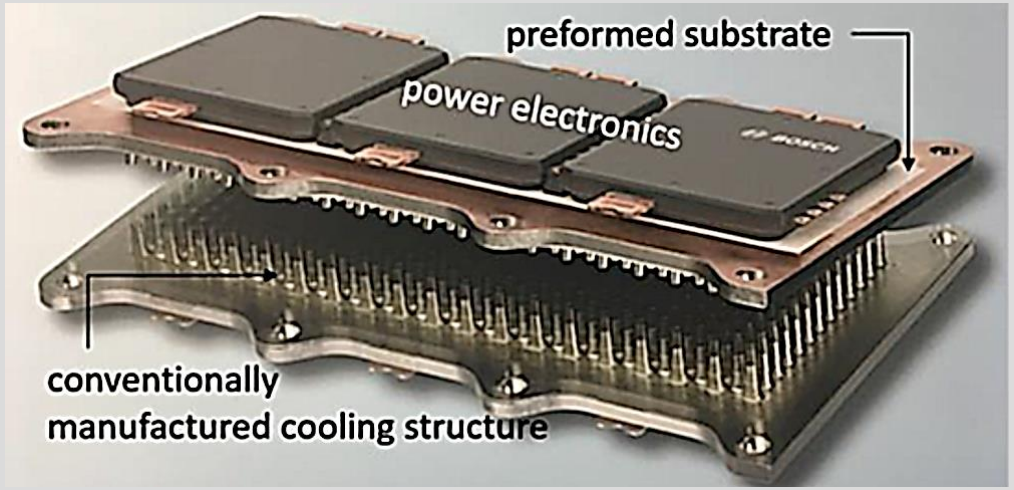

**Strongly growing inverter market**

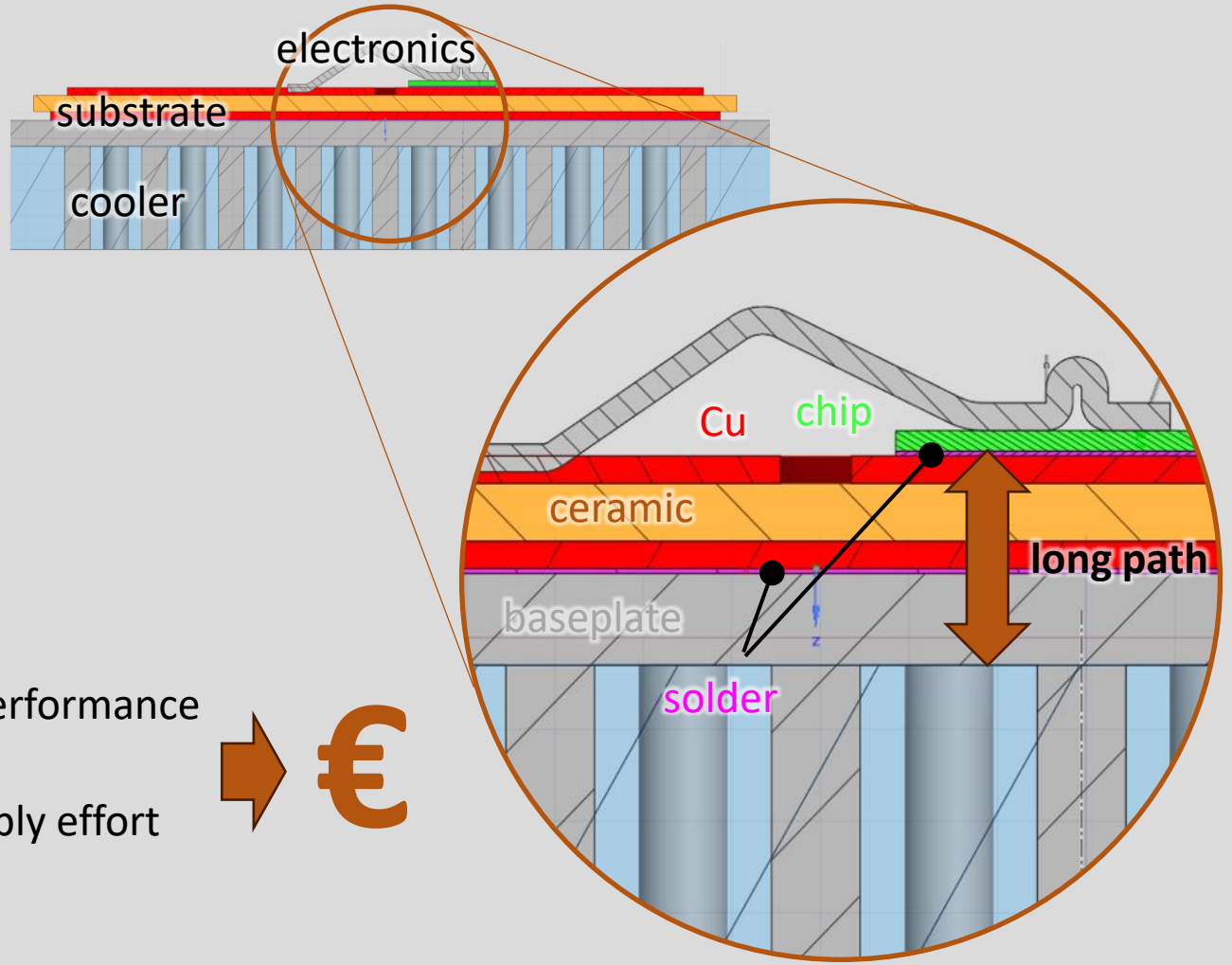
due to e-mobility + green energy production

- current market volume: 25 B$ for e-mobility only
- predicted +50 B$ market in 2032
- CAGR of 8-16%[1),2)]

1) www.precedenceresearch.com
2) www.polarismarketresearch.com

# Inverter Cooler State of the Art




**Conventional cooler design**

- high material usage
- limited design flexibility
- relatively long cooling path
- soldering/sintering required

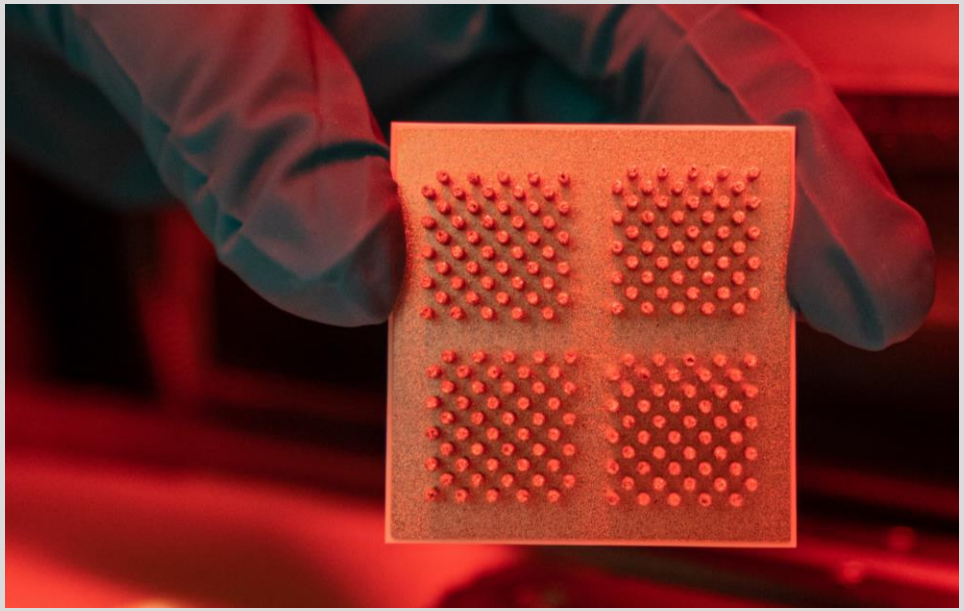
→

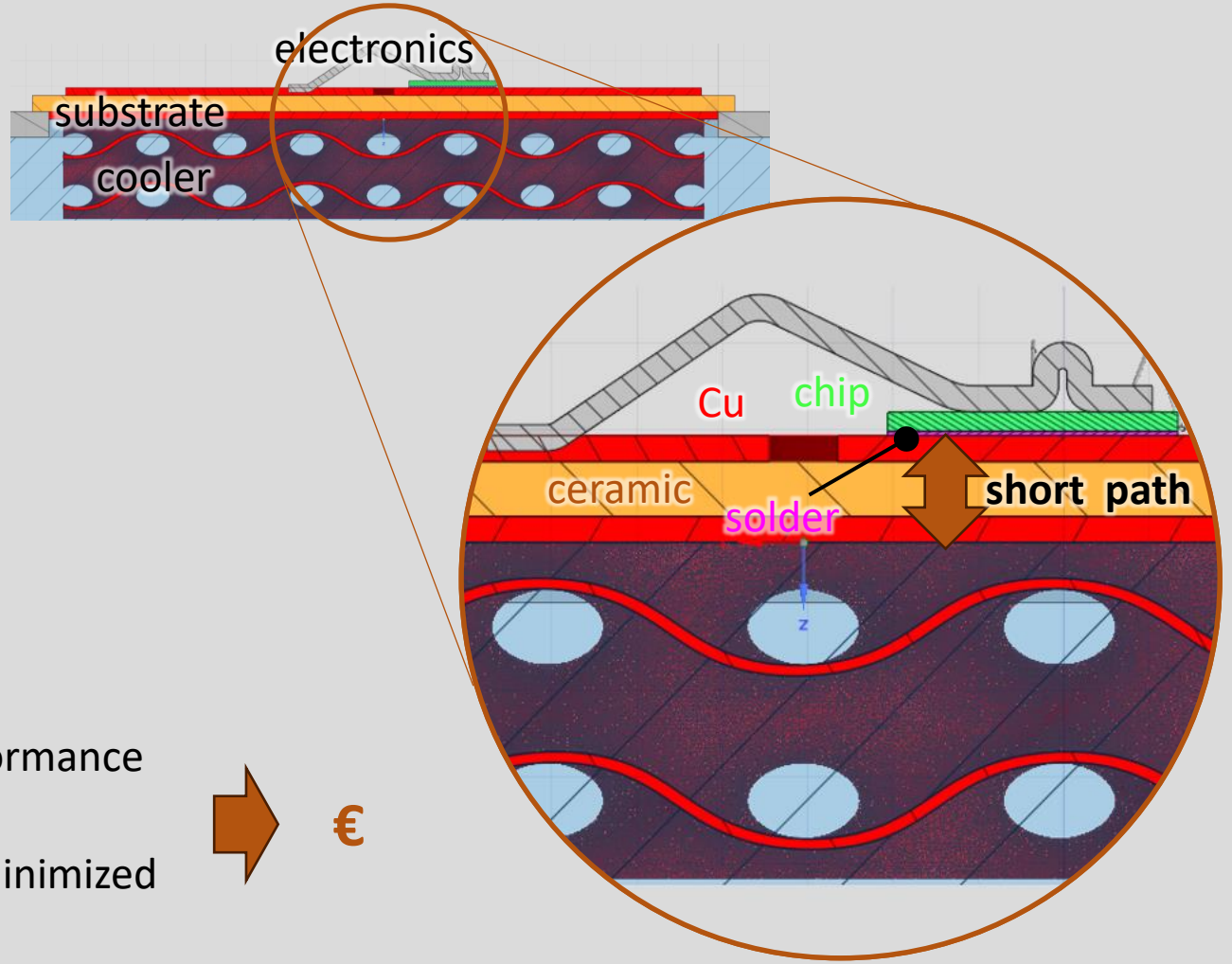
- limited cooling performance
- large chip size
- additional assembly effort

→ €


Funded by the European Union

# GlobalAM Cooler






**GlobalAM cooler concept**

+ minimum material usage
+ complexity for free
+ minimum cooling path
+ integrated joining process

→

+ high cooling performance
+ reduced chip size
+ assembly effort minimized

→ €


Funded by the European Union

# Contact

**Interested in partnering up? Ideas for your applications? Keen to bring in new materials?**
**You are welcome to contact us!**

**Project Homepage:**
https://www.globalam-project.eu/

**Contact:**
Robert Bosch GmbH, Dr. Frank Sarfert
Tel.: +49 711 811-10785
Mail: frank.sarfert@bosch.com