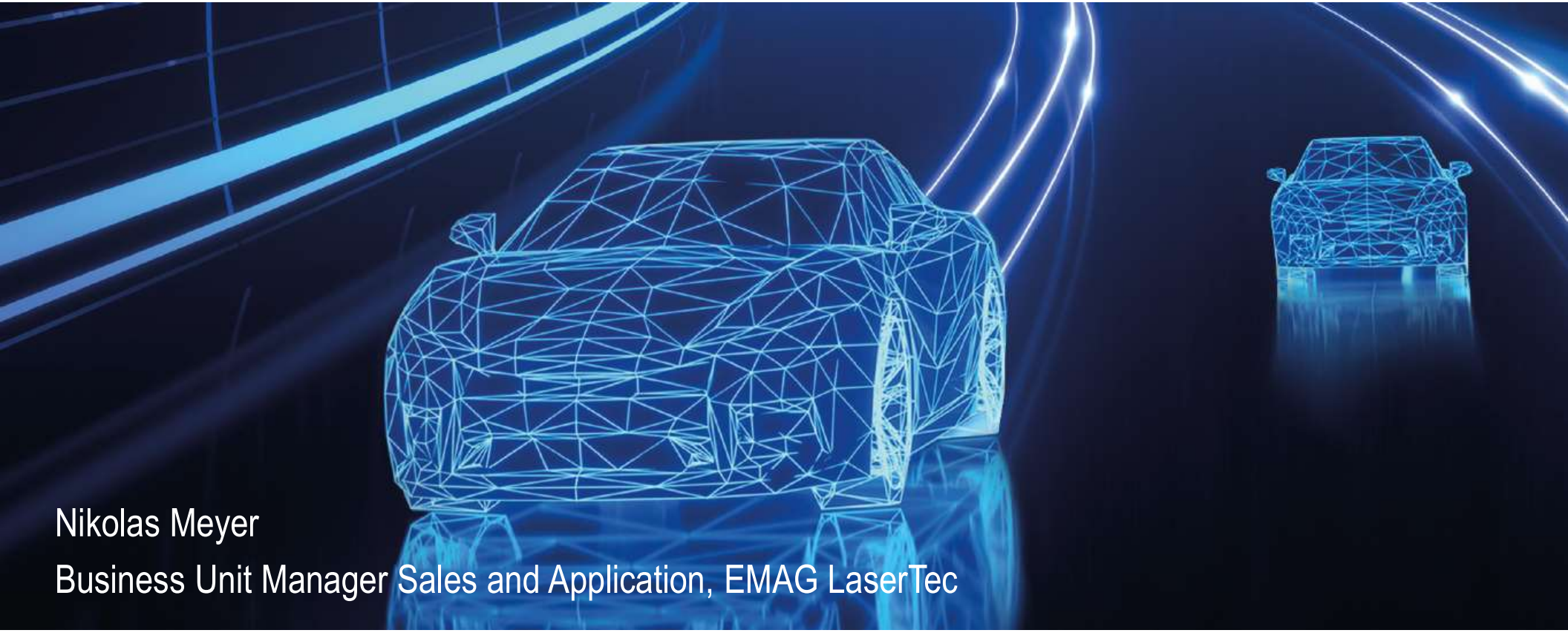
The Challenge of Reducing Fine Dust
Process and Large-Scale Production Development of Laser Hard Coated Brake Discs



Nikolas Meyer
Business Unit Manager Sales and Application, EMAG LaserTec

Laser Hard Coated Brake Discs

Content

1. Why?
2. Report out of the EMAG Laser Application Center
3. Modular Machine Concepts
4. Summary

Laser Hard Coated Brake Discs

Content

1. **Why?**
2. Report out of the EMAG Laser Application Center
3. Modular Machine Concepts
4. Summary

Laser Hard Coated Brake Discs

Fine dust pollutes people and the environment

Hard-coated brake discs are the preferred solution for compliance with the "EURO 7" fine particulate matter limits

- Air pollution leads to 4.5 million premature deaths per year[1]
- **Abrasion of a brake rotors** is a significant contributor to the damage to the environment and health[2]
- While exhausts have been significantly reduced in recent years, **non-exhaust emissions have remained** at a constant level[3]
- Consequently, **fine dust regulations** are being discussed and prepared by governments all over the world (e.g. European Union)

[1] German Medical Journal on February 12, 2020
[2] OECD (2020), Non-exhaust Particulate Emissions from Road Transport: An Ignored Environmental Policy Challenge OECD, Publishing, Paris, https://doi.org/10.1787/4a4dc6ca-en.
[3] Umweltbundesamt (2017), https://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/texte_43_2013_appelhans_e05_komplett_0.pdf

Laser Hard Coated Brake Discs

The EURO7 regulation

EUROPEAN COMMISSION

Brussels, 10.11.2022
COM(2022) 586 final
2022/0365(COD)

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7) and repealing Regulations (EC) No 715/2007 and (EC) No 595/2009

(Text with EEA relevance)

{SEC(2022) 397 final} - {SWD(2022) 358 final} - {SWD(2022) 359 final} - {SWD(2022) 360 final}

- EURO7
- Draft: 2022-11-10
- Regulation < 7 mg/km PM10
- Due date 2025-07-01
- all types (passenger cars and vans)
- From January 1st, 2035, a limit of <3 mg/km PM10 will apply

Laser Hard Coated Brake Discs

… why?

- Reduction of Fine Dust Emissions
- Wear Resistance
- Corrosion Protection

Coating of Brake Discs

is one strategy to meet future environmental regulation requirements for vehicle emissions.

Laser Hard Coated Brake Discs

Content

1. Why?
2. **Report out of the EMAG Laser Application Center**
3. Modular Machine Concepts
4. Summary

Laser Hard Coated Brake Discs

Report out of the EMAG Laser Application Center – LMD Prototype machine

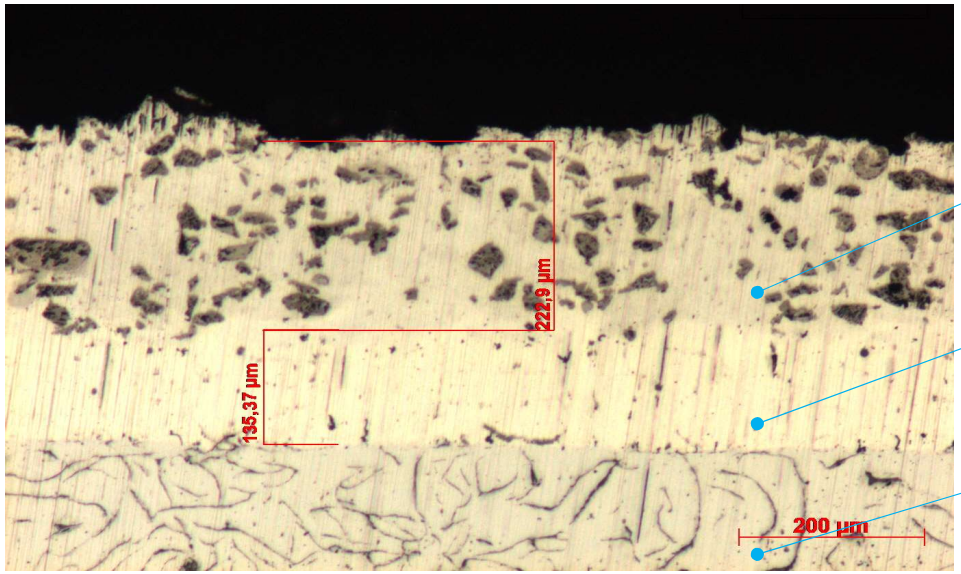
- A prototype machine for laser coating has been installed at the EMAG Laser Applications Center in Heubach since November 2020
- Equipment:
  - Laserline 22kW High-Power Diode Laser, incl. Optics
  - Trumpf TruDisk 12001 incl. technology package
  - Wecodur Technology packages
  - Powder feeders (disc) incl. powder nozzles
  - Induction Pre-Heating
  - Melting bath monitoring
  - Layer thickness measurement
  - Optical carbide content measurement
  - Metallurgical lab

Laser Hard Coated Brake Discs

Report out of the EMAG Laser Application Center – LMD polished section

Example:

Cross-section coating of an unground brake disc



Friction layer :
430 L + 30% Titanium carbides (broken)
Grain size 5-45µm
Layer thickness: approx. 220µm (before grinding)

Bonding layer:
316 L
Layer thickness: approx. 130µm

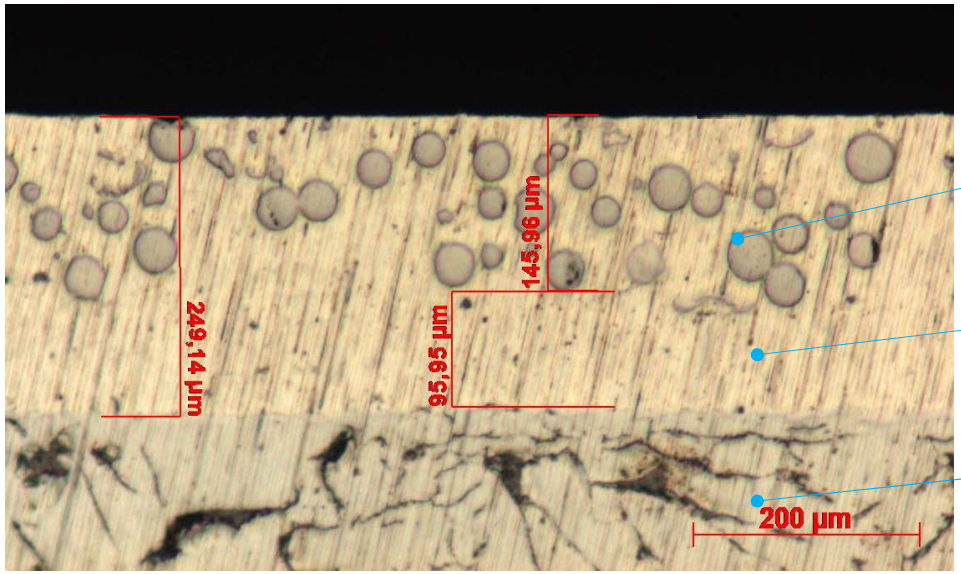
Workpiece material brake disc
Grey cast iron (GG 25)

Laser Hard Coated Brake Discs

Report out of the EMAG Laser Application Center – LMD polished section

Example:

Cross-section coating of a subsequently ground brake disc



Friction layer:
316 L + 30% Tungsten carbides (spherical)
Grain size 20-53µm
Layer thickness: approx. 200 µm (before grinding)

Bonding layer:
316 L
Layer thickness: approx. 90-100 µm

Workpiece material brake disc
Grey cast iron (GG 25)

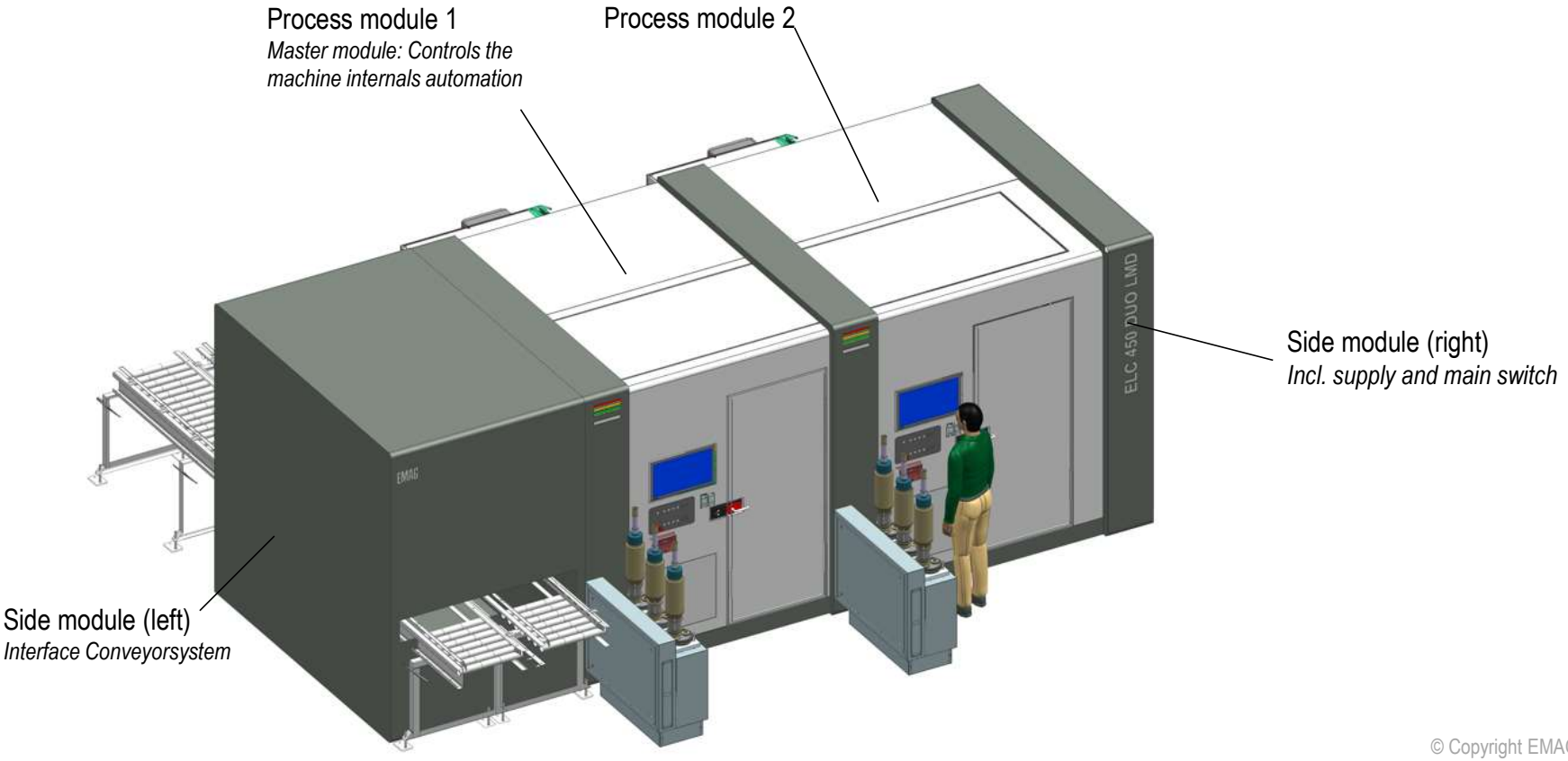
Laser Hard Coated Brake Discs

Content

1. Why?
2. Report out of the EMAG Laser Application Center
3. **Modular Machine Concepts**
4. Summary

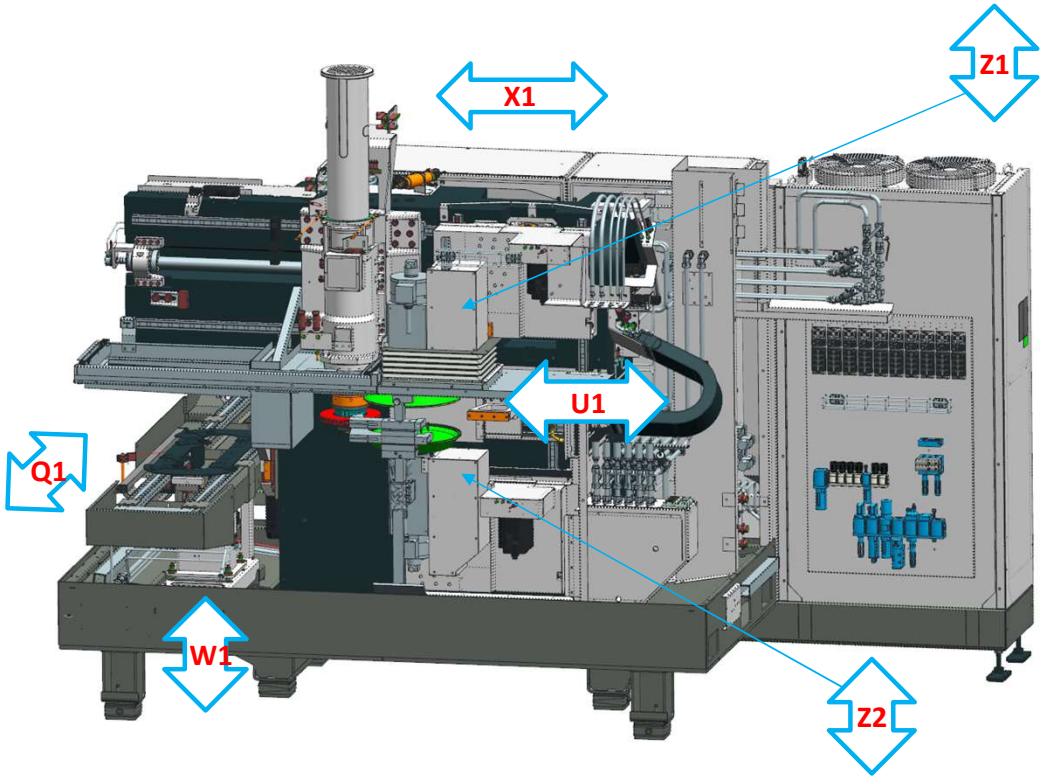
Laser Hard Coated Brake Discs

EMAG ELC 450 DUO LMD



Laser Hard Coated Brake Discs

EMAG VLC 450 DG – Grinding Machine



Laser Hard Coated Brake Discs

Content

1. Why?
2. Report out of the EMAG Laser Application Center
3. Modular Machine Concepts
4. **Summary**

Laser Hard Coated Brake Discs

Summary

- Fine dust regulation is expected not only for premium segment but in volume markets also
- Coated brake discs will significantly reduce brake-related particulate matter and offer further advantages in terms of wear and corrosion protection as well as weight savings
- Laser cladding is the efficient coating option for brake discs
- We expect large-scale series production on the horizon
- EMAG Application Labs to support customer‘s process development
- EMAG is as a turnkey supplier for the complete process chain of brake disc production, from soft machining and laser coating to the final grinding process

EMAG Group

Contact

Contact us!
You have a question or need more information? Contact us!

EMAG L.L.C. USA
38800 Grand River Avenue
Farmington Hills, MI 48335
USA
Phone **+1 248 477-7440**
E-Mail: **info@usa.emag.com**