# <u>can actericis</u>

#### ADVANCED MATERIAL FOR POWER ELECTRONICS AND ELECTRIC MOTORS



contact@cmmaterials.com

## Problem



Magnetic cores are large. 30-50% circuit footprint covered by inductors and transformers.

~41% loss comes from inductors in a power converters. Two thirds heat generation happens in inductors and transformers.



P<sub>LOSS</sub> Inductor 41%



### Inefficient





- 5x higher resistivity -> Higher efficiency
- 50% higher induction -> Miniaturization

	Electrical resistivity (uohm-cm)	Magnetic Induction (T)
CleanMag/CleanLam	>200	1.8-2.0
Incumbent metals/alloys	45-120	1.1-2.0



#### US20220392675A1

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#### MAGNETIC MATERIALS AND MANUFACTURING

(52) U.S. Cl.

Applicant: CM Materials Inc., Wilmington, DE (US)

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CPC ....... H01F 1/147 (2013.01); C01B 21/0622 (2013.01); C01B 21/0828 (2013.01); H01F 1/20 (2013.01); C01P 2006/42 (2013.01); C01P 2002/77 (2013.01); C01P 2002/72 (2013.01); C01P 2002/85 (2013.01); C01P 2004/03 (2013.01);







~50% lower magnetic loss



Reduce cooling requirement





## **CleanMag Magnetic core**





- **30-50%** smaller
- **50%** more efficient
- Remove active cooling
- Reduced manufacturing cost





- Inductor core
- Inverter
  DC-DC converter
  Transformer
  EMI Filter
  Power Factor Correction (PFC)

## Inductor Performance

#### Inductor core performance chart





Lower Loss and Higher Induction Cores



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- CleanMag cores have 50% more induction relative to
- Sendust
- CleanMag cores have 200-300% more induction relative to MnZn Ferrites • Driver for high current
- saturation leading to smaller magnetic components



**Magnetic induction** 



- CleanMag cores have 99.2%
  - permeability up to 500 kHz
- We developed 60u as the first product
- We have ability to change the permeability values between 30 and 120





### Permeability







### **Core loss**

• CleanMag demonstrated similar type of loss profile to Sendust core Potential to improve 50-60% more than that

### **Product Roadmap**



by end of 2Q23

equipment





#### We are improving the process and formulation every month

- Tentatively ready final formulation
- Capable to scale with off-the-shelf

### Sustainability



reduction by 1797 million Mt per year by 2050

Developed and manufactured in USA



#### No critical elements No Nickel or cobalt

#### **CO2** emission

#### Sustainable supply chain

### Traction

### Work in progress

**10+ SAMPLE ORDERS** 

Potential sales funnel >\$100M

Tier-1 and Tier-2 suppliers in consumer, industrial and EV





### Product roadmap







#### CleanLam Steel production for electric motor

2025

2027

Full production for magnetic core

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## Board of Advisors



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#### Alan Crapo



#### **Core loss**

