Corporate Presentation
Group Companies
Group Companies

COSMO GROUP

COSMO FILMS
- Backward Integration in chemicals, masterbatches and adhesives.
- An all in one solution to all pet products, Accessories and services.
- A global leader in speciality films for packaging, labeling, lamination and synthetic paper applications.

COSMO SPECIALITY CHEMICALS
- Speciality Chemicals for various industries.

zigly
- For Happy Pets

COSMO FERRITES LIMITED
- Leading manufacturer and exporter of Mn-Zn Based Soft Ferrite Cores for Power Electronic Industries.
- Manufacturer of Coils and Transformers
Establishment
Established in 1981, Cosmo Films Limited is one of the largest BOPP film players in the world with a sales turnover of USD 311 Million in FY 2018-19.

World Leader in Thermal Lam Films
Cosmo Films is the world’s largest producer of thermal lamination films.

Certifications
- ISO 9001:2000
- ISO 14001:2004
- British Retail Consortium (BRC)
- American Institute of Baking (AIB).

Promoter
Promoted by Mr. Ashok Jaipuria, 1st generation entrepreneur, who introduced the country to BOPP Films.

Public Listed
The company is listed on the Bombay Stock Exchange (BSE) & National Stock Exchange (NSE), India.

Awards & Recognition
Winner of several awards for innovation viz. PFFCA, Asia Star, SIES, SAP Hana, SAP Visionary etc.

Strong R&D Focus
Collective R&D experience of over 30 years
Recently received one patent for Release BOPP Film, holds 6 patents in India and 3 in the US
Have a state of the art R&D centre in Aurangabad.

Strong Export Footprints
Leading BOPP Films exporter from India with export to more than 100 countries.
MANUFACTURING FOOTPRINT

Waluj, Aurangabad, India
- BOPP: 5 lines
- Thermal: 2 lines
- Coating: 3 lines
- Metalizing: 1 line
- CPP: 1 line

Shendra, Aurangabad, India
- BOPP: 1 line
- Thermal: 4 lines
- Coating: 2 lines
- Metalizing: 1 line

Karjan, Vadodara, India
- BOPP: 3 lines
- Coating: 1 line
- Metalizing: 2 lines
- CPP: 1 line
- CSP: 1 line

Asan, Korea
- Thermal: 1 line

TOTAL INSTALLED CAPACITY
- BOPP: 2,00,000 TPA (9 lines)
- Thermal: 40,000 TPA (7 lines)
- Coating: 16,000 TPA (6 lines)
- Metalizing: 20,000 TPA (4 lines)
- CPP: 9,000 TPA (2 lines)
- CSP: 7,200 TPA (1 line)

* Shrink film production planned in 2022
**BOPET line to be commissioned by 2022
COSMO SPECIALITY CHEMICALS
A 100% Subsidiary of Cosmo Films

**Brand Purpose**
To enrich lives with chemistry, responsibly.

**Vision**
“To be a preferred specialty chemicals company, constantly innovating for a better & safer tomorrow”.

**Mission Statement**
To provide eco-friendly consumer centric products that bring in enhanced functionalities and aesthetics.
COSMO SPECIALITY CHEMICALS

Adhesives

PSA Adhesives
- Eco friendly adhesive
- Linerless PSA
- Better Tack

Water Based Adhesives

Solvent Based Adhesives
- For Chemical Drums
- Electronic Labels

Dry Lamination Adhesives
- High Speed machine applications
- Better Bonding
- Better gloss
- Better mileage

Wet Lamination Adhesives
- Applicable over all films
- No Corrosive effect on metalized film

Solvent Based PU Adhesives
- Better Bonding
- Faster Curing
- Better Pot Life

Flexible Packaging Adhesives
- Multilayer Film
- High speed application
- Faster Curing
- Better Bonding
- Better Pot Life

Solvent Less PU Adhesives

COSMO SPECIALITY CHEMICALS
COSMO SPECIALITY CHEMICALS

Masterbatches

White Masterbatch
Anti-blocking Masterbatch
Slip Masterbatch
Antistatic Masterbatch
Cavitating and Pearl Masterbatch
Matt Compound
COSMO SPECIALITY CHEMICALS
A 100% Subsidiary of Cosmo Films

Adhesives
800 T/Month by 2025-26

B2C
PVA Wood adhesives
- High bond strength and Quick setting and long term bond.
- Termite and humidity resistant.

Acrylic Construction adhesives
- Admixture for cements better binding and water resistance.
- Water proofing polymer additive.
- Alternative for mechanical fasteners and rivets.
- Excellent for joining dissimilar substrates

Acrylic PSA
- Environmental friendly durable adhesives.
- Clear removable.
- Linerless PSA.

B2B
PVA Lamination
- High speed applications.
- Very good green bond.

Epoxy for flooring & Metal bonding
- Formulations for Low temp curing one component system
- User friendly application

• Environmental friendly durable adhesives.
• Clear removable.
• Linerless PSA.
• Formulations for Low temp curing one component system
• User friendly application
Brand Purpose

Happy Pets - Our Purpose is to give happy and healthy lives to the furry companions who makes our lives whole.

Vision 2025

“To build India’s largest Pet care ecosystem connecting Pet families with compassionate reliable and competent caregivers”.

Mission Statement

Pet families  To provide easy access to reliable, standardized and quality pet care that enhances the joy of pet parenting.

Care Givers  To provide steady and equitable income opportunities to pet lovers who chose to transform their passion in to profession.
OUR INITIATIVES AND ACHIEVEMENTS

**Infrastructure**
- R&D labs with most sophisticated equipment and instruments, one in India & another one in USA.

Some of the equipment & instruments:
- Barrier Testing (OTR & MVTR).
- Differential Scanning Calorimetry (DSC)
- Thermo Gravimetric Analysis (TGA)
- Dynamic Mechanical Analyzer
- Mass Spectrometer (MS).
- Optical Microscope.
- Dynamic Mechanical Analyzer.
- FTIR – Microscope
- Scanning Electron Microscope (SEM).
- UV spot coating and screen printing.
- ANSI Barcode scanner.
- UV Flex proof 100.

**Achievements**
- Recognition and certification by Department of Scientific & Industrial Research, Government of India.
- Recently received one patent for Release BOPP Film.
- Multiple patents with 6 in India and 3 in the US.
- Multiple product development Awards such as India star, IFCA STAR and PFFCA STAR awards.
- First thermal lamination film to take extrusion coating without the primer.
SUSTAINABLE PRODUCT PRACTICES

Offer mono-material poly-olefin films for ease of recycling.

Designed heat resistant BOPP films replacing BOPET; mostly used in print layer, giving last push to creation of mono-material structures.

Company has been partnering with some of the best global brands to offer structure rationalization.

Both BOPP and CPP films offer better yield, hence enabling reduced consumption of plastics.

UV stabilized Synthetic Paper can be used to replace PVC in outdoor promotional applications for shorter duration requirements up to one year.

Use of Water Based Coatings.

Offer Oxo-Biodegradable Films.

Offer a suitable substitute for aluminum foil in form of its Ultra-High Barrier Films.
PILLARS OF COSMO FOUNDATION
(SOCIAL RESPONSIBILITY)

**Education**
- Basic Computer Literacy & Digital Skill Building
- Basic English Literacy & Fluency Development
- Cosmo Gyan Vihar Kendra - Native Language, Maths, Life Skills & Values
- Educational Counselling & Career Guidance
- Cosmo Computer Award & Children’s Fair
- Cosmo Digi Pathshala - Online Learning Platform for rural students
- Cosmo Computer Award & Children’s Fair
- Cosmo Udyan Shalini Fellowship - 30 Girls sponsored
- Exposure & Trainings of Youth and Teachers
- Celebrations of National Days & Festivals
- Computer & English courses in Summer break
- Parents Engagement
- Educational Counselling & Career Guidance
- Parents Engagement
- Edupedia

**Health & Sanitation**
- Toilets in Rural Schools No: 100
- Sanitary Pad Bank for Girls in Rural Schools
- Oral Hygiene awareness & Dental Check-ups
- Nutrition & Reproductive Health awareness
- Toilets in Rural Schools No: 100
- Sanitary Pad Bank for Girls in Rural Schools
- Oral Hygiene awareness & Dental Check-ups
- Nutrition & Reproductive Health awareness
- Behavioural Change

**Environment**
- Tree Plantation With Farmers and Rural Schools No: 6000+
- Garden Development at Aurangabad Airport & Karjan Flyover
- Waste Bins Installations in Rural Schools No: 400+
- Water Tanks in Rural Schools No: 6
- Tree Plantation With Farmers and Rural Schools No: 6000+
- Garden Development at Aurangabad Airport & Karjan Flyover
- Waste Bins Installations in Rural Schools No: 400+
- Water Tanks in Rural Schools No: 6

**Beneficiaries since Inceptions**
- 40000 Students
- 1 Lakh Community Members
- 42 Govt. Schools
- 112 Extended Villages
CORPORATE GOVERNANCE

Well established practices in place

1. Well qualified Board of Directors from diversified fields
2. with majority of directors being independent.
3. Independent Audit Committee with Board of Directors.
4. Established risk management practices.
5. Experienced and independent internal audit function.
6. Active Whistle Blower Policy.
COSMO FERRITES LIMITED
A LEADING MANUFACTURER OF SOFT FERRITE CORES
Established in 1986, Cosmo Ferrites Limited is one of the largest soft ferrite manufacturer in India.

**Capabilities**

- Soft Ferrites (Mn Zn) capacity 80Mn Pc/ Month
- In house Ferrite Powder capacity 3600 MT.

**Accreditations**

- ISO 9001:2015
- ISO 14001:2015
- ISO/TS 16949
- UL94 V-0

**Stake Holders**

- **Mr. Ashok Jaipuria**
  - 1st Generation Entrepreneur, introduced the country to Soft Ferrite Cores.

- **Mr. Ambrish Jaipuria**
  - CEO & Executive Director at Cosmo Ferrites Ltd.
## Who We Are

<table>
<thead>
<tr>
<th>Manufacturing Plant</th>
<th>PUBLIC LISTED</th>
<th>EMPLOYEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Located in the foothills of Himalaya. Area 20600 sq m.</td>
<td>Listed on the Bombay Stock Exchange (BSE)</td>
<td>720+ employees</td>
</tr>
</tbody>
</table>

### VISION
To become the Product and Quality leader of soft ferrite cores.

### MISSION
We endeavour to be an organization which delivers outstanding customer service, respects all individuals working with it and always encourages initiative & innovation.

### VALUES
- Conduct business with integrity and fairness.
- Focus on our customer’s need.
- Excellence in quality & customer service.
- Mutual respect and teamwork.
Cosmo Ferrites Journey So Far

Established in 1987 Cosmo Ferrites Ltd. commenced its production with an annual capacity of 10 Mn Pcs.

- **1986-1987**: Incorporated
- **1988**: In-house R&D setup with the help of DSIR (GoI)
- **1989-1994**: 5 new materials and 8 shapes introduced
- **1995-2000**: Component capacity enhanced to 12 Mn Powder Capacity to 1500 Mt
- **2001-2005**: New Kiln Added, Increased Component Capacity to 20 Mn Pcs
- **2006-2010**: Further expanded its component capacity to 35 Mn Pcs
- **2010-2014**: Started exports in other Asian Countries
- **2015-2016**: New Vertical
- **2016-2021**: Component Capacity Increased to 50 Mn Pcs.
- **2022-2023**: State of the Art New KILN Introduced
- **2021-2023**: Production capacity increased 50% to 80 Mn Pcs

- **2006**: Accelerated Exports to Europe and US - 50 countries
- **2016**: Global Leader
- **2015**: Forward Integration Alisha Coils & Transformers Launched to offer customized solutions
- **2010**: Component Capacity enhanced to 40 Mn Pcs
- **2005**: Expanded its component capacity to 20 Mn Pcs
- **2001**: Growth
- **2000**: Productivity
- **1995**: Expansion
- **1988**: Inhouse R&D
- **1987**: Established
Professional Team

Mr. Ramesh Chaudhary
AGM (SMC, IT & Costing)

Mr. P K Jain
Sr. Manager (Domestic Marketing)

Mr. Pradeep Sharma
Manager (Export Marketing)

Mr. Ravi Luthra
Manager HR

Mr. Rajesh Kumar
Manager Purchase

Mr. Satya PVV
Business Head ACT
Awards Recognized by ELCINA for continuous growth and development.

ELCINA-EFY Certificate of Merit for Outstanding Achievement in “Exports/Large Scale” Year 2016-17

ELCINA-EFY Certificate of Merit for Outstanding Achievement in “Exports/Large Scale” Year 2013-14

43rd ELCINA-EFY Award for Outstanding Achievement in “Exports/Large Scale” Year 2017-18

ELCINA-EFY Certificate of Merit for Outstanding Achievement in “Exports” Year 2020-21
Business Journey

Sales Revenue
IN MILLION US$

Geography Wise %

FY 2021-22

Asia 64%
Europe 28%
Turkey 3%
USA 3%
Others 1%

CAGR 25%
CAGR 13.4%

Revenue:
- 1989: 0.5
- 1994: 1.4
- 1999: 2.5
- 2004: 3.2
- 2009: 3.9
- 2014: 7.4
- 2019: 10.1
- 2021: 16
- 2022: 20
- 2023: 25
- 2024: 31

Growth Rate:
- CAGR 25%:
- 1989-1994: 1.4
- 1994-1999: 2.5
- 1999-2004: 3.2
- 2004-2009: 3.9
- 2009-2014: 7.4
- 2014-2019: 10.1
- 2019-2021: 16
- 2021-2022: 20
Our Customers - Domestic

- Havells
- Orient Electric
- Surya
- Osram
- Medha
- Dassani Industries
- Cresta
- Blistering Electronics Pvt Ltd
- Rapidtron Electrononika
- Rosy Electronics Pvt Ltd
- Syrma SGS
Our Customers - Domestic
Our Customers - Export

- TRIO
- InTiCa Systems
- Danfoss
- PTR Hartmann
- Delta Electronics, Inc.
- Schaffner
- Bosch
- Iskra
- WiTricity
- ABB
- Philips
- Tamura
Company Presence Global

1. 64% - Asia
   India | China | Sri Lanka
   Thailand | Taiwan
   Malaysia | Vietnam | Japan

2. 28% - Europe
   Germany | Italy | Poland
   Czech Republic | Spain
   United Kingdom | France
   Ukraine | Denmark

3. 3% - North America
   United States of America

4. 3% - Turkey

5. 1% - Others
   Africa | Brazil | Latin America | Oceania
Distributor Network
Compliance with Global Standards

IATF 16949
ISO 9001:2015 (ACT)
ISO 9001:2015 (CFR)
ISO 14001:2015
UL94 V-0 Approved Coating
Segments We Serve - Ferrites

**Automotive**
- Antenna, Sensors

**Solar**
- Inverter, Current Sensor

**Industrial Electronics**
- Medical, Power Supplies

**Electric Vehicle**
- Battery Charger, OBD, Wireless Charging

**EMI Filters**
- Line Filter, Choke

**Lighting**
- Inductor, Transformer
## Segments We Serve – Wound Components

<table>
<thead>
<tr>
<th>Segment</th>
<th>Products</th>
</tr>
</thead>
</table>
| **E-Vehicle** | • DC-DC Converter  
               • AC-DC Converter  
               • Motor Controller  
               • Battery Charger  |
| **LIGHTING**  | • Electronic ballast for energy efficient lamps  
               • Electronic chokes for Tubular Lamps  |
| **POWER CONDITIONING**  | • Medical electronics  
               • Telecom  
               • SMPS  
               • Induction  |
| **EMI FILTERS**  | • Battery Chargers  
               • Solar invertors  
               • Sensors  |
| **CHARGERS**  | • Mobile Charger  
               • Setup Box Charger  
               • RO Charger  
               • Adopters  |
### Product Categories - Ferrites

<table>
<thead>
<tr>
<th>Core Type</th>
<th>Sizes Available</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EE Cores</strong></td>
<td>10 mm to 128 mm</td>
<td>Power Transformer and Inductors</td>
</tr>
<tr>
<td><strong>Pot Cores</strong></td>
<td>14 mm to 36 mm</td>
<td>Power Transformers, Power Inductors, Converters, Inverters, SMPS and Filter Inductors</td>
</tr>
<tr>
<td><strong>Toroid (With and Without Coating)</strong></td>
<td>06 mm to 202 mm</td>
<td>Wide Band and Pulse Transformers and Common Mode Chokes</td>
</tr>
<tr>
<td><strong>RM Cores</strong></td>
<td>05 mm to 14 mm</td>
<td>Power and Wide Band Transformer; High Q Inductors and Tuned Transformers</td>
</tr>
<tr>
<td><strong>UU Cores</strong></td>
<td>10 mm to 141 mm</td>
<td>Power Transformer and Inductors</td>
</tr>
<tr>
<td><strong>EER/ETD Cores</strong></td>
<td>29 mm to 59 mm</td>
<td>Power Transformer and Inductors</td>
</tr>
</tbody>
</table>
Product Categories - Ferrites

PQ Cores
- Sizes Available from 20 mm to 71 mm
- Application – Power Transformer and Inductors

EC Cores
- Sizes Available from 35 mm to 90 mm
- Application – Power Transformer and Inductors

PM Cores
- Sizes Available from 50 mm to 87 mm
- Application – Power Conversion Transformer

Planar Cores
- Sizes Available from 18 mm to 153 mm
- Application – Differential Inductors and DC/DC, AC/DC converters

I Bars, Plates
- Sizes Available from 20 mm to 186 mm
- Application – Antennas, High Frequency Welding, EV Charging.

EFF Cores
- Sizes Available from 15 mm to 30 mm
- Application – Excellent space utilization for transformers and inductors
Product Categories - Wound Components
# Our Approach to Sustainability

## Technology
- Customized innovation
- Product Life Cycle Ahead on curve
- Wide product portfolio

## Environment
- Carbon footprints reduction
- Low Emission / Zero Emission
- People health, safety and well beings

## Values
- Sincerity
- Humility
- Integrity
- Passion
R&D, Quality & Technology
About Ferrites

Ferrite

(A class of advanced electro-ceramics having **magnetic** properties which contains **iron oxide** as a major ingredient)

Soft Ferrite
(Inductors & transformer)

- Mn-Zn Ferrite
  - Low loss material for efficient power transmission
  - High permeability material for filter application

Hard Ferrite
(Permanent magnet)

- Ni-Zn Ferrite
  FY24
  (For EMI / EMC with high impedance)
# Ferrite Material Profile

## POWER GRADE MATERIAL / LOW LOSS MATERIAL

**Key properties**
- Low power loss
- High magnetic flux density
- High Curie Temperature

**No. of material grades available in Cosmo-09**

**Typical Grades** - CF 292 (High $B_{sat}$), CF297 (low loss), CF295 (temperature stability), CF 139 (moderate power loss)

## HIGH PERMEABILITY MATERIAL

**Key properties**
- High permeability
- Low loss factor

**No. of material grades available in Cosmo-08**

**Typical Grades** - CF 195 ($\mu_i$ 5000), CF 190 ($\mu_i$ 6000), CF 197($\mu_i$ 7000), CF 199 ($\mu_i$ 9000)
Quality Management Principles

• Customer-Centric Organization
• People involvement
• Process Approach
• Systematic Approach :- Indigenous ERP to track traceability, control and access to every stage with progress status.
• Continual Improvement plans and its tracking
• Factual Approach to Decision Making
• Mutually Beneficial Supplier Relationships
Customer complaint reduced (FY 2020-21 vs 2021-22): 30%

Reduced customer returns of total sale (FY 2020-21 vs 2021-22): 0.65% - 0.3%
Quality Compliance

• Our products conform to IEC standard for all electrical and mechanical parameters of ferrite.

• Compliant with RoHS and REACH standards

International Electrotechnical Commission (IEC)
A leading global organization head quartered at Geneva, Switzerland that sets the International Standards for all electrical, electronics and related technologies.
Quality Gates

**Raw Material Inspection**
- XRF analysis, SSA, Particle size distribution

**Powder Preparation**
- XRF, SSA, Granulate Size distribution, Bulk Density, Moisture content, Granulate flowability

**Pressing**
- Visual, Dimensions, Green Density

**Packing**
- Quality Assurance
- Final Testing

**Grinding and Finishing**
- Visual Checking, Dimensions, Electrical Properties

**Sintering**
- Visual Checking, Dimensions, Sintered density, Electrical Properties
Material Development-Ongoing R&D Projects

Present portfolio

- Low loss at 100°C
  Material Grade: CF297
  Power loss: 400 kw/m^3 at 100°C, 100 KHz, 200 mT

- High saturation
  Material Grade: CF292
  Saturation: 480 mT at 25°C, 10 KHz, 1200 A/m

- Average µi 9000 at 10 KHz, 25°C
  Material Grade: CF199

Target profile

- Low loss at 500 KHz
  Material Grade: CF249
  Power loss: 80 kw/m^3 at 500 KHz, 100°C, 50 mT

- Ultra low loss at 100 KHz, 200 mT
  Material Grade: CF298
  Power loss: 250 kw/m^3 at 100°C, 100 KHz, 200 mT

- Low loss at high ambient temperature (140°C)
  Material Grade: 289
  Power loss: 400 kw/m^3 at 140°C, 100 KHz, 200 mT

- Ultra high saturation
  Material Grade: CF293
  Saturation: 600 mT at 25°C, 10 KHz, 1200 A/m

- Average µi 10000 at 10 KHz, 25°C with improved frequency response up to 200 KHz
  Material Grade: CF199 A

July 6, 2022
R&D Roadmap(2022-2025)

- **CF298**
  - Q2' 2024-25
  - Power loss 250 kW/m³ at 100°C, 100 KHz, 200 mT

- **CF293**
  - Q1' 2023-24
  - Saturation flux density 600 mT at 25°C, 10 KHz, 1200 A/m

- **CF289**
  - Q4' 2023-24
  - Power loss 400 kW/m³ at 140°C, 100 KHz, 200 mT

- **CF250**
  - Q2' 2023-24
  - Power loss 800 kW/m³ at 3 MHz, 100°C, 30 mT

- **CF249**
  - Q4' 2022-23
  - Power loss 80 kW/m³ at 500 kHz, 100°C, 50 mT

- **CF199A**
  - Q2' 2022-23
  - \( \mu \) 10,000 at 10 kHz, 25°C with improved frequency response up to 200 kHz
R&D Resource Center

Material characterisation & quality control

**XRF** for determination of material composition and purity level accurately

**Particle size analyser** for determination of particle size distribution in powder material

**Computerised BET surface analyser** for determining specific surface area of powder materials

Product synthesis and evaluation

**Atmosphere controlled kiln**

**Powerloss set up**

**Transformer analyser**

**LCR Meter**

**Hi-Pot tester**
Expansion of R&D Resource Center (Planned)

- **Powerloss combined with B-H loop tracer** capable to measure up to 3 MHz—Planned in Q2 ’2022-23

- **High resolution digital microscope (1000 x)** for determining granulate shape, size, defects and micro crack—Planned in Q3’2022-23

- **Precision Impedance analyzer** capable to measure up-to 100 MHz—Planned in Q4’2022-23

- **XRD** for determination of crystalline phases present in ferrite system—Planned in 2023-24
Ferrite Application
Application Team

Mr. Binod Aggarwal
Expert in Power Electronics Application
M Tech in Power Electronics from IISC (Bangalore)

Mr Binod Agarwal brings with him more than 35 years of experience in companies like Cree, Wolfspeed. He’s having number of patents in power electronics field like:

<table>
<thead>
<tr>
<th>Description</th>
<th>Patent Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totem pole converter system.</td>
<td>10224809</td>
</tr>
<tr>
<td>Hybrid analog and digital converter controller.</td>
<td>9606564</td>
</tr>
<tr>
<td>Boost converter with reduced switching loss and method of operating the same.</td>
<td>9564806</td>
</tr>
<tr>
<td>Control system for a flow cell battery.</td>
<td>9035617</td>
</tr>
<tr>
<td>Bi-directional buck boost circuit.</td>
<td>8723489</td>
</tr>
<tr>
<td>Solar power systems including control hub.</td>
<td>20140285023</td>
</tr>
</tbody>
</table>

Dr. Palas K. Haldar
Expert in Electro ceramics
M Tech, Ph. D in Material Science from University of Calcutta

Dr Palas K. Haldar has 10 papers published in various international and national journals and conferences in the field of ceramics.

Mr Karuna Sagar
New Product Development
M Tech in Material Science from Thapar University, Patiala

Mr Vikas Thakur
Application Engineer
B Tech in Electronics & Communication from HPTU, Simla.
Application

EV Charger

• **Integrated Magnetics(Inductor+ Transformer)**
  Working on optimized shape of transformer and magnetic volume
  Cost Effective
  Better Performance

• **Distributed gap magnetics** for PFC converters and resonance inductors for LLC converters.
  Better Performance at higher frequencies

• **Integrating shim inductors** along with transformer for PSFB topology

• **Integrating common mode choke and differential mode** chokes in one common magnetic structure
Shapes under consideration

- Torroid core with a central limb. Main magnetizing inductance is controlled by the torroid and leakage can be designed with the central limb.
- Planar core with 2 section in the middle instead of conventional single.
- EE core with unequval limb core areas and unequal limb air gaps.
- PQ core with double central limbs with equal or unequal area.
Comparison

1kW, 100kHz, \(V_{\text{in}}=400\text{V}, V_{\text{out}}=40\text{V}\), Limb area=125mm\(^2\), \(L_m=250\mu\text{H}, L_r=51\mu\text{H}\)

<table>
<thead>
<tr>
<th></th>
<th>Tr3 (Un-equal gap)</th>
<th>Tr2 (Un-equal gap)</th>
<th>Tr2 (Equal gap)</th>
<th>Separate Xformer</th>
<th>Separate Inductor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary turns</td>
<td>72.4</td>
<td>73.1</td>
<td>65.9</td>
<td>27.15</td>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td>Sec turns</td>
<td>7.84</td>
<td>7.97</td>
<td>12</td>
<td>5.43</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Copper loss (W)</td>
<td>4.48</td>
<td>3.97</td>
<td>4.53</td>
<td>3.08</td>
<td>1.98</td>
<td>5.06</td>
</tr>
<tr>
<td>Core loss (W)</td>
<td>1.59</td>
<td>1.6</td>
<td>1.81</td>
<td>1.63</td>
<td>.653</td>
<td>2.2</td>
</tr>
<tr>
<td>Copper weight</td>
<td>80.5</td>
<td>81.8</td>
<td>94</td>
<td>59</td>
<td>47.2</td>
<td>106.2</td>
</tr>
<tr>
<td>Core weight</td>
<td>76.3</td>
<td>76.7</td>
<td>87</td>
<td>74</td>
<td>36</td>
<td>110</td>
</tr>
<tr>
<td>Gap (Left, center, right) mm</td>
<td>1.7</td>
<td>.1</td>
<td>1.7</td>
<td>3.5</td>
<td>.9</td>
<td>.1</td>
</tr>
</tbody>
</table>

Flux density

Note: comparison at 100Khz,1KW and a max flux density of 100mT, separate transformer and inductor are on PQ core whereas for others, cylindrical 3 limb structure has been assumed.
DISTRIBUTED AIR GAP DESIGN OF THE INDUCTOR

- Fringing of the flux near air gap is increased due to air gap. Larger air gap means more fringing Fig(a) (top left).
- Fringing of the flux near the air gap causes extra eddy current losses in nearby conductors Fig(b) (top right).
- Fringing effect can be substantially reduced by providing 3 or more smaller air gaps Fig(c) (bottom).
- Fringing reduces the effective air gap of the core.
- Eddy current effect shall be more pronounced in LLC inductor and transformers compared to PFC inductor.
- One of the main dis-advantages of the ferrite core is that it saturates suddenly. This also can be reduced with distributed core.
Integrating Common mode and differential mode choke.

- Different configurations are possible. One possibility is with EE core.
- Other possibility is with toroid by adding another central limb.
- Differential mode inductance may be tweaked by putting extra winding on the central limb.
- Be careful about the flux in right and left limb as flux due to differential mode adds in one and subtracts in another.
- Good estimation of common mode current is needed to compute correct flux density in core.
- Need to develop a model for impedance curve vs frequency.

Better efficiency and material saving by integrating common mode and differential mode chokes
Operations
Operation & Infrastructure – Wound Components

MULTI SPINDLE LINE

60Mn Pcs/Annum

SINGLE SPINDLE LINE

5.5Mn Pcs/Annum
Powder Production Process

- **Mixing & Homogenizing** (Eirich Dry Mixer)
- **Pelletizing** (Pelletizer)
- **Pre sintering** (Rotary kiln)
- **Coarse Milling** (Ball Mill)
- **Fine Milling** (Attritor mill)
- **Organic Mixing** (Slurry Tank)
- **Spray Drying & granulation** (Spray Dryer)
Pressing Process

**ROTARY**
- Smaller geometry
- 0.5-24 g green core weight /pc

**DORST**
- Medium geometry
- 25 g - 350 g green core weight /pc.

**HYDRAULIC**
- Larger geometry
- 350 g to 2 kg green core weight /pc.
Sintering

Kiln 1
- Brand: Reidhammer
- Capacity: 10 Mn Pcs/month
- Year of installation: 1996

Kiln 2
- Brand: Reidhammer
- Capacity: 10 Mn Pcs/month
- Year of installation: 2007

Kiln 3
- Brand: Reidhammer
- Capacity: 18 Mn Pcs/month
- Year of installation: 2011

Kiln 4
- Brand: Reidhammer
- Capacity: 20 Mn Pcs/month
- Year of installation: 2015

Kiln 5
- Brand: CTEC
- Capacity: 27 Mn Pcs/month
- Year of installation: 2022
Grinding

Rotary Grinder

Precision Grinder

2 Station Automatic Grinding Line

4 Station Automatic Grinding Line
Expansion Plan: Increasing Capacity of Powder Production

3600 MT / annum to 6600 MT/Annum
SOP - Q 1 2023

Salient features

• Compact production system
• Precise batch composition
• Continuous and efficient process
• Improved process control
Expansion Plan: Top Hat Kiln for Sintering 10000 to 14000 μi

Capacity of 300 MT / annum
SOP Q4 -2022

Salient features

- Sintering of high end materials with improved performance
- Precise atmospheric control
- Perfect system for
  - high permeability (μi 10000)
  - Ultra low loss power material(80 kw/m³ at 500 KHz)
  - Ultra high saturation (B_{sat} 600 mT at 25°C)
Future Expansion Plan- FY24

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Reach Us

NEW DELHI
Head Quarters:
517, 5th Floor, DLF Tower-A, New District Centre, Jasola, New Delhi – 110 025, India

HIMACHAL PRADESH
Regd. Office and Works
Post Office – Jabli
District – Solan
Himachal Pradesh – 173 209
India

Email-Id: sales@cosmoferites.com
Disclosure:

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Thank You