IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

DISTRIBUTED DISC STRUCTURED MAGNETOELECTRIC COMPOSITE DEVICE
IITM Technology Available for Licensing

Problem Statement

- Existing **magnetoelectric devices** lack self-biased behavior and **struggle to achieve high ME coefficients efficiently.**
- There is a **need for ME devices** with enhanced **self-biased behavior and improved ME coefficients** to enable more efficient and practical applications in **micro-ME sensors and devices.**

Technology Category/ Market

Category – Magnetoelectric Composite Devices
Applications – Micro Magnetoelectric Sensors, Electromagnetic Signal Detection, Magnetic Field Sensing, Energy Harvesting Devices
Industry – Electronics and Semiconductor, Healthcare and Medical Devices, Automotive and Transportation, Aerospace and Defense, Energy and Renewable Energy
Market -The global magnetic sensor market was valued at USD 4.43 billion in 2021 and is expected to grow at a **CAGR of 7.5%** over the forecast period.

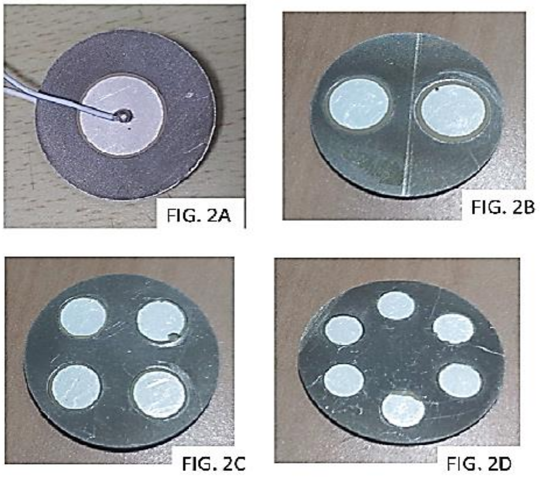

FIG. 2A illustrates a 1-disc Distributed Disc Structure (DDS) or a disc/ring configuration.
FIG. 2B illustrates a 2 discs Distributed Disc Structure (DDS) configuration.
FIG. 2C illustrates a 4 discs Distributed Disc Structure (DDS) configuration.
FIG. 2D illustrates a 6 discs Distributed Disc Structure (DDS) configuration.

Technology

Composite Material Design:
The invention employs a **unique combination of magnetostrictive and piezoelectric materials** with **controlled volume fractions to create a composite material structure.**

Mechanical Interference Fit:
The use of a precise mechanical interference fit, ranging from 0.3% to 1% of disc diameter, imparts prestress within the material, enabling self-biased magnetoelectric behavior.

Optimized Disc Distribution:
Piezoelectric material is distributed as discs within the magnetostrictive material, enhancing the ME response.

Material Selection:
Utilizes negatively magnetostrictive materials (e.g., nickel or Samfenol-D) and specific piezoelectric materials (e.g., PZT-5A or PZT-5H) for their compatibility and properties.

Enhanced ME Coefficients:
Achieves impressive static and dynamic self-biased magnetoelectric coefficients, making it suitable for various applications, including micro-ME sensors and devices

Intellectual Property

- **IITM IDF Ref. 2134**
- **IN 387760 (PATENT GRANTED)**

TRL (Technology Readiness Level)

TRL-4/5 Technology validated in lab and relevant environment

CONTACT US
Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website: https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Key Features / Value Proposition

Technical Perspective:

This invention offers **enhanced ME coefficients** through precise material control, **enabling highly efficient ME sensors.**

User Perspective:

Users benefit from improved **sensitivity and reduced external requirements in ME sensors**, with potential applications across industries.

Image

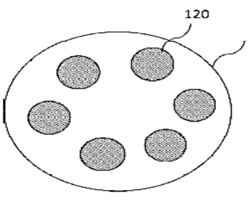

FIG. 1A

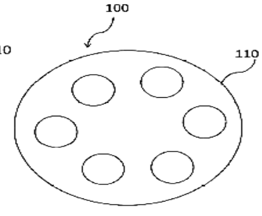

FIG. 1B

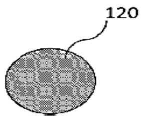

FIG. 1C

FIG. 1A illustrates the magnetoelectric composite device.
FIG. 1B illustrates the magnetostrictive material.
FIG. 1C illustrates the piezoelectric material disc.

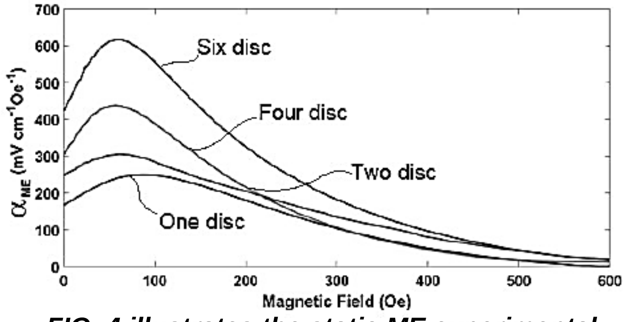

FIG. 4 illustrates the static ME experimental results obtained from the four DDS configurations.

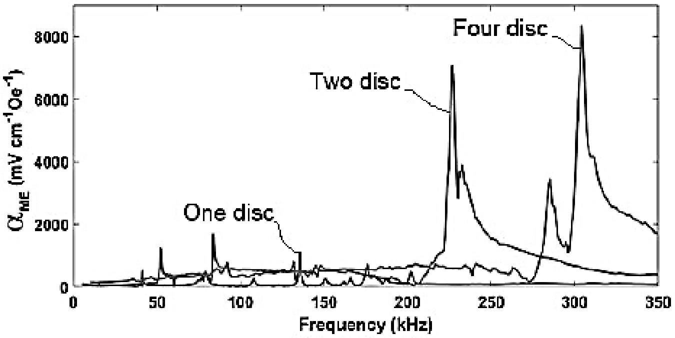

FIG. 5

FIG. 5 shows the dynamic ME coefficient of the various DDS configurations as a function of frequency.

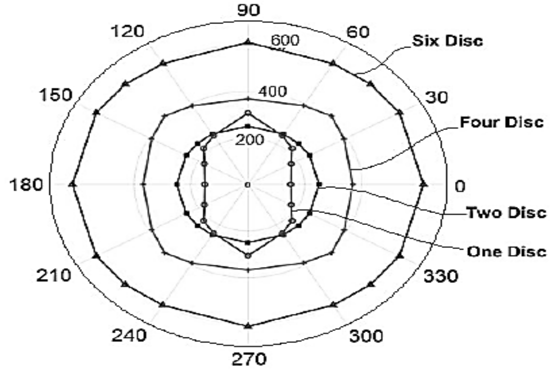

FIG. 6

FIG. 6 illustrates the polar representation of the dependence of the static ME response of various DDS configurations on their spatial placement in the magnetic field.

Research Lab

Prof. A. Arockiarajan
Dept. of Applied Mechanics

CONTACT US

Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website: https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in

Phone: +91-44-2257 9756/ 9719