CTS | Ferroperm Piezoceramics

PiezoPaint™

Contents

PiezoPaint™ - Piezoelectric Ceramic Material for Flexible Substrate Compatibility

PiezoPaint™ is a novel piezoceramic technology from CTS Ferroperm Piezoceramics, specifically developed with soft and flexible substrate compatibility in mind.

PiezoPaint™ can easily be applied to a wide variety of flexible materials such as textiles, plastics and paper. It can also be deposited onto large areas by means of common commercial printing techniques, including screen, pad and stencil printing, as it cures at low temperatures (< 100°C).

PiezoPaint™ excels as a highly sensitive and broadly applicable alternative to PVDF matrials, often used in combination with textiles and for large area deposition. PiezoPaint™ exhibits a significantly higher piezoelectric activity with a greater piezoelectric charge coefficient. It is also very easy to produce in large quantities. These features make it a very versatile material with the adaptability to serve in many and varied functions.

Electrode on PiezoPaint™ patch

Material Properties	Symbol	Unit	Value
Relative Dielectric Permittivity at 1 kHz	K_{33}^{σ}	-	80
Dielectric Dissipation Factor at 1 kHz	tanδ	10^{-2}	3.5
Coupling Factor, Thickness	k_t	%	8.2
Piezoelectric Charge Coefficients	$d_{31}^{(1,2)}$	pC/N	15
	$d_{33}^{(1)}$	pC/N	40
Frequency Contant, Thickness	N_t	Hz•m	1410
Acoustic Impedance	Z_a	MRayl	13.9
Density	ρ	g/cm^3	5.0

1 - Semi-clamped, in case of films printed onto substrate

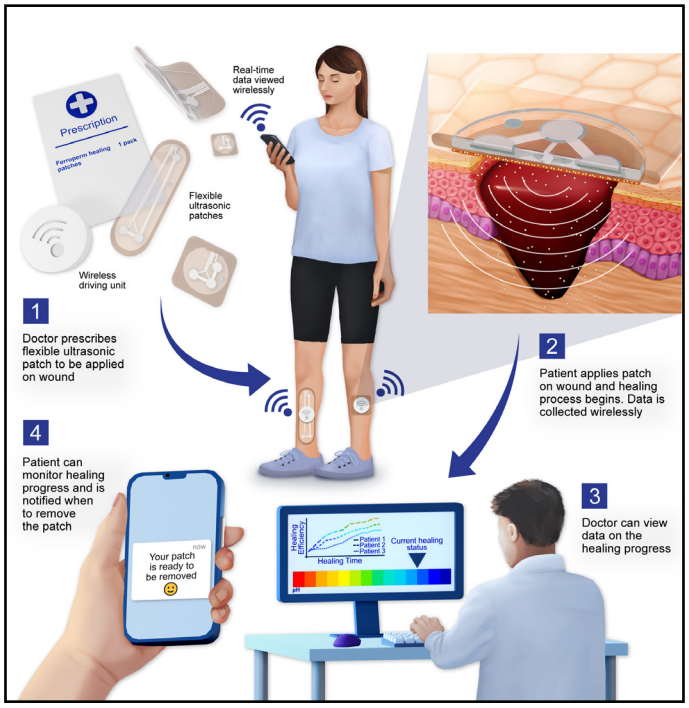
2 - Estimated value, under evaluation

Potential Applications

Thanks to its excellent compatibility with flexible substrates and the ease with which it can be manufactured, PiezoPaint™ opens up a realm of opportunities for next-gen piezoelectric technologies and applications. Based on our PiezoPaint™ technology, we have designed and developed a number of innovative prototypes, including buzzers and sensors that can be incorporated into garments, various textiles and other soft fabrics. We have also had good experiences using PiezoPaint™ in conjuction with printed circuit boards (PCBs).

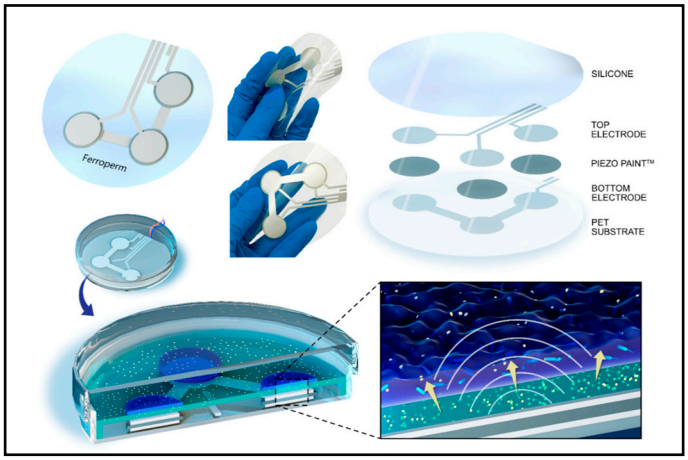
Example: Therapeutic Ultrasound

We envision a medical path for PiezoPaint™ which could encompass for instance smart bandages capable of administering medicine and stimulating wound recovery. Our R&D division is working with researchers from high-ranking universities to explore and unlock the medical potential of PiezoPaint™ and develop new prototypes based on the material.



PiezoPaint™ application proposition. Kvich et. al., 2022.

A recent collaborative study[1] between the Department of Immunology and Microbiology at Copenhagen University and Ferroperm Piezoceramics showed that the combination of antibiotics and low-frequency ultrasound generated by a patch made of PiezoPaint™ was highly effective against otherwise resistant biofilm-forming bacteria which are present in the majority of chronic wounds.



PiezoPaint™ structure for in vitro study. Kvich et. al., 2022.

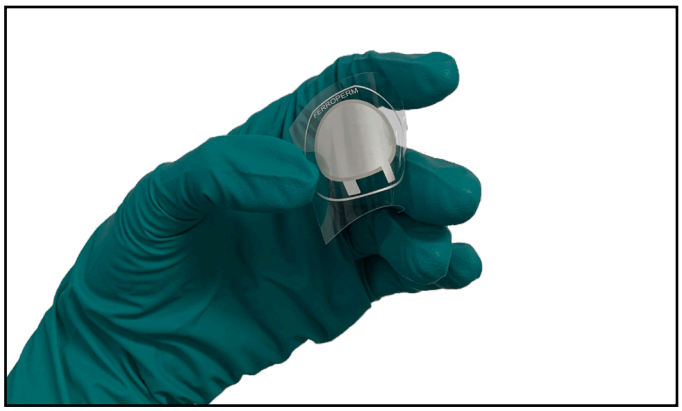
In another joint study[2], with researchers from the Department of Health Science and Technology at Aalborg University, a multi-well device based on PiezoPaint™ was developed and employed to radiate human dermal fibroblast cells with ultrasonic energy in order to reduce their growth as excessive collagen production by the fibroblasts is the root cause of abnormal scarring during wound regeneration. The radiation resulted in a significant reduction of fibroblast growth and extracellular matrix deposition without changes to cell viablility or adhesion.

1 Kvich, Christensen, Pierchala, Astafiev, Lou-Møller, Bjansholt, 2022: The combination of of Low-Frequency Ultrasound and Antibiotics Improves the Killing of In Vitro Staphylococcus aureus and Pseudomonas aeruginosa Biofilms

2 Porsborg, Krzyslak, Pierchala, Trolé, Astafiev, Lou-Møller, Pennisi, 2023: Exploring the Potential of Ultrasound Therapy to Reduce Skin Scars: An In Vitro Study Using a Multi-Well Device Based on Printable Piezoelectric Transducers

Joint Product Development

Studies as these provide a good indication of the potential medical applicability of PiezoPaint™, and of course, they are just a few of many possible utilizations. With its unique versatility, PiezoPaint™ could see use in various instances where a flexible link between mechanical and electrical energy is required.



Flexible patch of PiezoPaint™ with electrodes

To unlock the full potential of the material, we highly encourage joint product development. Through our Innovation Hub innitiative, we have established a platform that enables external developers to test and optimize product designs using our state-of-the-art equipment and facilities. To interested parties, we are offering free samples of our PiezoPaint™ material, comprised of a sandwich-type structure with silver top and bottom electrodes and an active PiezoPaint™ layer in between. The structure is printed on a 125 µm thick polyester susbtrate measuring 25mm x 25mm with an active element diameter of 6mm. If you would like to print the material yourself, PiezoPaint™ paste is available and can be purchased for non-commercial use.

For more information, contact our Innovation Hub at dk.innovation@ctscorp.com.

About Ferroperm Piezoceramics

Ferroperm Piezoceramics in an industry-leading developer, manufacturer and supplier of high-end piezoceramics component. Since its founding in 1952, the company has continuously provided customers around the world with products of the highest quality for use in complex and demanding medical and industrial applications. An integral part of CTS Corporation, Ferroperm Piezoceramics is located in Kvistgård, Denmark, from where its has established an extensive sales and support network spanning across Europe, Asia and the Americas. The company is certified to the ISO 9001 quality control standard and the ISO 14001 environmental management standard.

About CTS Corporation

Headquartered in Lisle, Illinois, USA, CTS Corporation (NYSE: CTS) is a leading designer and manufacturer of products that Sense, Connect and Move. The company manufacturers sensors, actuators and electronic components in North America, Europe and Asai, and provides engineered products to customers in the aerospeace/defense industrial, medical and transportation markets.

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