

# Thin Printed Piezoelectric Sensors for Human Machine Interfaces

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Human machine interfaces (HMIs) represent one of the most integral of a modern car interior – transducing user inputs into useful electronic signals. In creating these interfaces, constituent electronic parts such as displays, lighting, and sensors must be seamlessly combined. Using printed electronics, these electronic parts can be made into a thin and flexible form factor, while using low cost and scalable processing methods. In this work, we demonstrated the exploitation of printed piezoelectric sensors that can be used for dynamic force sensing in an HMI. Our solution can be integrated on plastic parts either by lamination or direct printing.

We have demonstrated the fabrication of an all-printed, transparent, piezoelectric sensor based on the polymer PVDF-TrFE. The use of screen printing to make this sensor enables high throughput and low-cost fabrication of thin piezoelectric sensors. In addition, this fabrication method can also enable the creation of large arrays of piezoelectric sensors. These arrays can constitute all the required buttons in an HMI. Though the sensor is printed, its electromechanical behavior is equivalent with that of stretched PVDF homopolymer films.

The sensors were integrated on the backside of an acrylic plate in order to validate its utility as a force sensitive button in an HMI. This simple demonstration shows that even under slight deformations, the sensors are sensitive to force, such that a charge per unit force of -30 pC/N could be measured. The measured amount of charge can be used to differentiate light and strong presses of the button.

We anticipate that the presented solution has several advantages, namely: (i) printability (additive manufacturing process, high throughput, customizable), (ii) excellent sensitivity, and (iii) simple integration onto plastic parts. This can represent a unique and powerful solution for complex HMIs that are needed in future automotive interiors.



Fig. 1 Futuristic human machine interface with integrated force sensors.

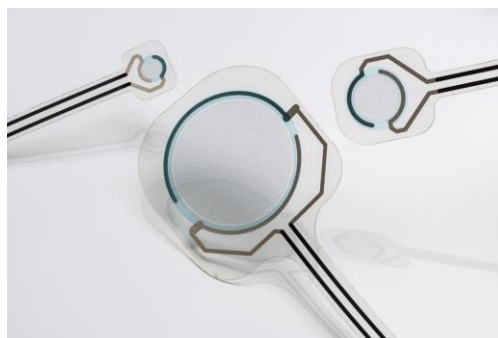


Fig. 2 All-printed, transparent piezoelectric force sensors.