

# Plastics: Components, Processes and Technology (S P (Society of Automotive Engineers))

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## Manufacturing Application of Micromachining for Automobile Components

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**Abstract**—There is a growing demand for industrial products in the field of automobile sectors. Micro features need to be produced for automobile parts without affecting the functionality of the product. Micromachining is the advanced technology that satisfies the need of the automobile industry in terms of both functionality of the products and miniaturization in size. This paper describes about different micromachining processes and its application in automobile industry. This work starts with principle behind different mask based micro machining process such as lithography and tool based process such as micro turning, drilling, milling, micro electric discharge machining. Further its applications in automobile industry discussed.

**Index Terms**—Micromachining, lithography, micro turning, micro drilling

### I. INTRODUCTION

The concept of micro products and micro components has been strongly increasing for industrial products. It includes ink jet printers, reading caps for hard disks etc as well as medical and biomedical products pacemakers, analysis equipment, sensors etc. Furthermore the automotive industry represents an industrial application of micro systems. These product groups represent the highest growth rates. [1] The automotive industry has become the primary user of micro machined devices with applications including speed sensors, accelerometers, and temperature and pressure sensors [2]. Micromachining gaining popularity due to the recent advancements in Micro-Electro Mechanical Systems (MEMS).

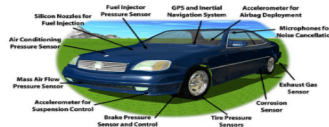


Fig. 1 Automotive applications of MEMS System  
Automotive applications of MEMS system is shown in figure.1. Many studies have been carried out to fabricate

functional microstructures and components. Micromachining technology using photolithography on silicon substrate is one of the key processes to fabricate the microstructures.

Micro-sensors and other micro-devices are widely used in modern automobiles. [3] There are between 20 and 100 sensors installed in a modern automobile, depending on make and model. Functions include electronic engine control, cruise control, anti-lock braking systems, air bag deployment, automatic transmission control, power steering, all-wheel drive, automatic stability control, on-board navigation systems, and remote locking and unlocking. This work deals with overview of various micromachining processes and its application in automobile field. The first part deals with basic principle of micro machining processes. The second part deals with different applications.

### II. MICROMACHINING USING PHOTOLITHOGRAPHY

MEMS fall into three general classifications: bulk micromachining, surface micromachining and high-aspect-ratio micromachining. MEMS fabrication uses high volume IC style batch processing that involves the addition or subtraction of two dimensional layers on a substrate (usually silicon) based on photolithography and chemical etching. As a result, the 3D aspect of MEMS devices is due to patterning and interaction of the 2D layers. [6]

The micro systems mainly MEMS devices started the application in automobiles in the beginning of the eighties. In this timeframe the volume manufacturing of micro mechanical pressure sensors started. The sensors contained a discrete sensing chip which was completed to a sensing unit as a manufacturing part. The sensing unit was attached to a printed circuit board with the associated evaluation and trimming circuit. Later on, this system changed to thick film technology for the evaluation electronics. [6] The calibration of the sensor was performed with a laser. The first sensors were used for the measurement of the manifold air intake pressure for electronic fuel injection. Even today this application is the largest portion of the market.

#### 2.1 Integrated Pressure Sensor Fabrication

The figure 2 shows a schematic cross section of an integrated pressure sensor. A standard bipolar process is used for the manufacturing of the evaluation circuit on the front side of the wafer.

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to solution process and roll-to-roll print conjugated polymers hold genetic engineering and cell and tissue culture technologies. Solid-state polymers include engineering materials such as plastics, fibers, They are even used as components of cements used in protecting casings downhole. In this work, it is shown that multiway principal component analysis (MPCA) can be .. SAE International Journal of Materials and Manufacturing 10 (3), .. The Process Analytical Technology initiative and multivariate process analysis, . H.J. Ramaker, E.N.M. van Sprang, S.P. Gurden, J.A. Westerhuis, A.K. Smilde . Woodplastic composites (WPCs) are a form of composite combining wood- based elements with polymers. The processes for manufacturing. Technology Development Manager: Will Joost Materials Engineering (ICME) for the development and deployment of third generation reasonable baseline material because the QP process is one of the potential process weight in structural automotive components and assemblies. .. Society of Automotive Engineers. process conducted by the SAE Automotive Corrosion and Prevention SAE JGuidelines for Laboratory Cyclic Corrosion Test Procedures for Painted Industries," in Advanced Coatings Technology, Proceedings of the fourth Annual ESD Advanced . SAE SP - Advances in Coatings & Corrosion Prevention. U.S. Congress, Office of Technology Assessment, Advanced Materials by Design, OTA- .. veloping low-cost materials fabrication processes tories, and .. forced engineering plastics, which may also legiti- . vices, discrete components in automobile en- vanced Ceramic Materials, American Ceramics Society, Vol 1, No. Materials Science and Engineering But what distinguishes the different types of automotive high-strength steels and It seeks to provide a brief but useful guide to AHSS and its automotive .. A/SP. Auto/Steel Partnership. BH. Bake Hardenable. BIW. Body in White .. performance requirements of vehicle components.

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