Project code : MW2-01

Project Title : Micro-microphone

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Microphone is a device which convert mechanical energy to electrical energy. One of its common usages is to convert acoustic sound wave to electrical signals. Every microphone has a membrane to collect acoustic sound waves. The modern design of microphone uses capacitive membrane for microphone. When sound wave strikes on the membranes, the distance between the membranes will vary. Since the capacitance is inversely proportional to the distance between two membranes, the deflection can be detected by measuring the capacitance.

![Diagram of the working principle of a capacitive microphone](image)

In our final year project, we have fabricated the capacitive microphones on silicon wafers by the micro-fabrication technology. The process consists of 12 photographys which were carried out in HKUST Microelectronic Fabrication Facility Laboratory. The project goal was to determine the best process to fabricate the silicon microphone by comparing the different designs with their electrical and mechanical characteristics. If the best process flow is found out, we can fabricate the silicon microphone with extreme small size, high yield and low price in the product line.
After fabricated the microphone, the capacitive membrane and the PMOS transistor amplifiers are formed on the silicon wafers. The top view is show on Fig.3. After that, the electrical characteristics of the PMOS transistors were tested (Fig.4, Fig.5). These curves show that the transistors work! It implies that fabricating the capacitive microphone on silicon wafers is possible.
Vds-Id characteristic of 150A transistor

Fig.4 Vds-Id characteristic

Vgs-Id characteristic of 150A transistor (Log scale)

Fig.5 Vg-Id characteristic (Log scale)

This is one of our “real” products. It has three microphones together with different dimensions (2mm*2mm, 3mm*3mm and 4mm*4mm). Is it very small??