Preparation and property of diaphragm type CMC pressure sensor

○*Mika Kamei*, Takashi Katsuno, Hironori Natsuhara, Toshikazu Sekine, Kazuaki Hashimoto*, Kyoko Miwa*, Keiji Kawabe**、Seiji Motojima
(Faculty of Engineering, Gifu university, *Toukai Medical Products, **CMC Technical Development)

(Abstract) Carbon micro coil synthesized by decomposition of acetylene gas have double helix structure. Therefore electrical properties such as impedance |Z| and resistance were changed with extension-contraction of CMC itself. CMC tactile sensor element obtained by mixing CMC with elastic matrix can detect contact pressure. Many researchers have studied influence of size of element, matrices, configuration of CMC and CMC loading. Though, because of deformation difficulty of sensor element, it was hard to detect small pressure change at pressurized air. In this work, in order to solve the problems, we tried to develop novel pressure sensor element leads to comparatively large deformation induced by small pressure change, and did property evaluate.

Principle of CMC sensor

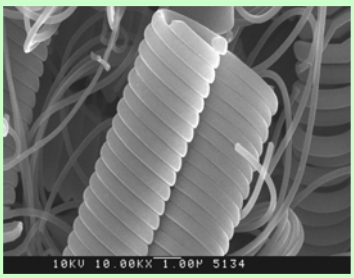
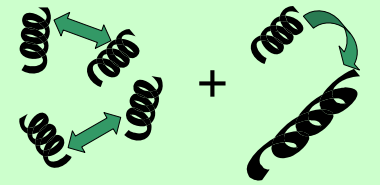


Fig. 1. SEM image of double helix CMC.

Inner CMC sensor element...



Electrical parameter change

Prototype pressure sensor

CMC 7 wt% (300～500μm) + GE Toshiba silicone YE 5623 ⇒ CMC/silicone composite

Fig. 2. Photograph of CMC 18wt% / polysilicone pressure sensor element.

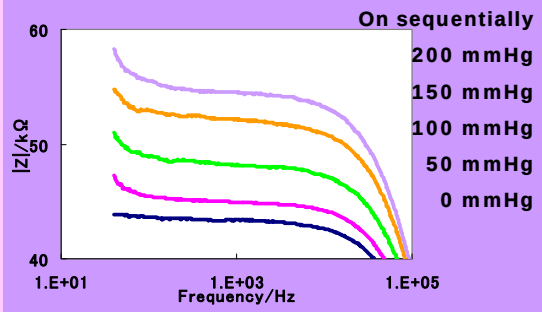


Fig. 3. Frequency properties of prototype pressure sensor element in different pressure conditions.

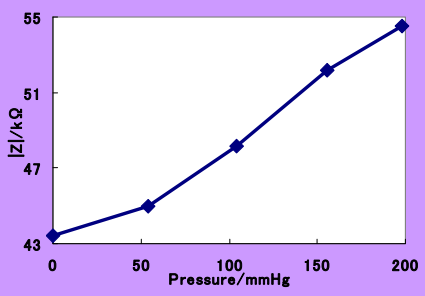


Fig. 4. Impedance change of prototype pressure sensor element in pressurization.

Compression of CMC sensor element with pressurizing increase |Z|.

Diaphram sensor

Fig. 5. Photograph of Diaphram sensor element.

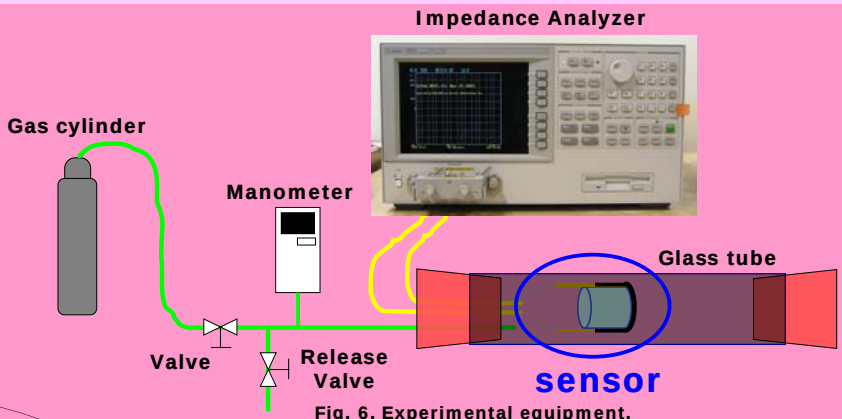


Fig. 6. Experimental equipment.

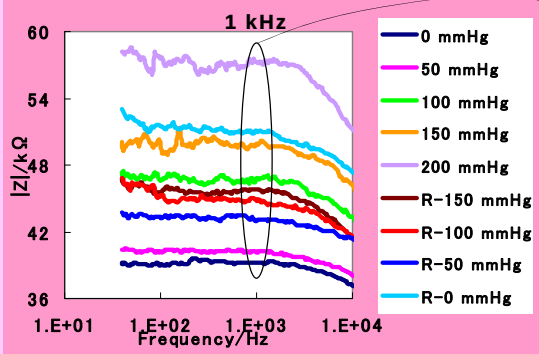


Fig. 7. Frequency properties of diaphram sensor element in different pressure conditions.

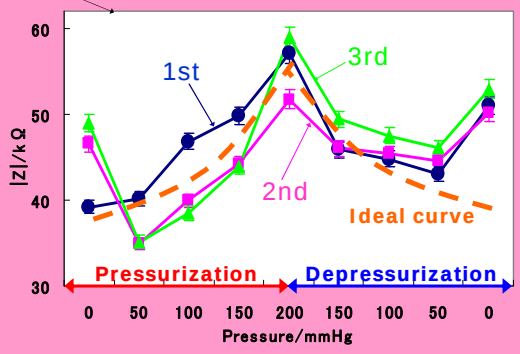


Fig. 8. Impedance change of diaphram sensor element applied different pressure.

Impedance |Z| increased with pressurizing and decreased with depressurizing. Since excess deformation of thin film produced residual strain, when depressurize to 0 mmHg in 1st curve, |Z| value was different from start value. This phenomena also looked in start and finish of 2nd and 3rd curve.

★Conclusions★

①CMC/ polysilicone thin film was deformed by such a small pressure change, leading to electrical parameter change.

②In order to increase signal, we prepared diaphragm type CMC pressure sensor element having very thin film. Though, we found that excess deformation of CMC/ polysilicone thin film produced residual strain.

③We need to consider a novel structure having quick recovery and possibility of miniaturization.