

# Preparation and characterization of CMC tactile sensor elements

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CMC tactile sensors made of CMC/silicone rubber composites has been widely studied and were found to have a high sensitivity and a high performance in narrow dynamic ranges. But it is necessary to study their sensing properties in wider dynamic ranges when they are expected to be applied to the artificial skins or the humanoid robots. Therefore, in this study, we investigated the characterization of CMC tactile sensor elements for the purpose of widen their dynamic range.

## Experimental process

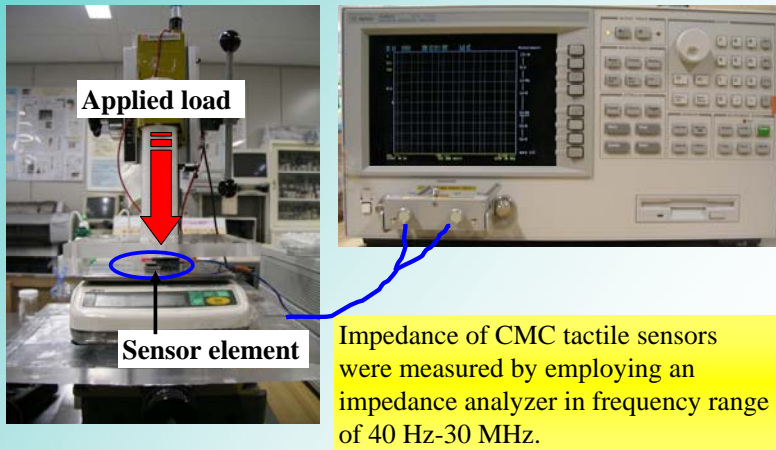


Fig. 1. Image of the experimental equipment

## Single layer type

Matrix	CMC length	CMC content [wt%]	Composite thickness [mm]	Applied load [gf]
Soft (GE Toshiba YE5623)	Over 1 mm	7	3 5 7	0-3000

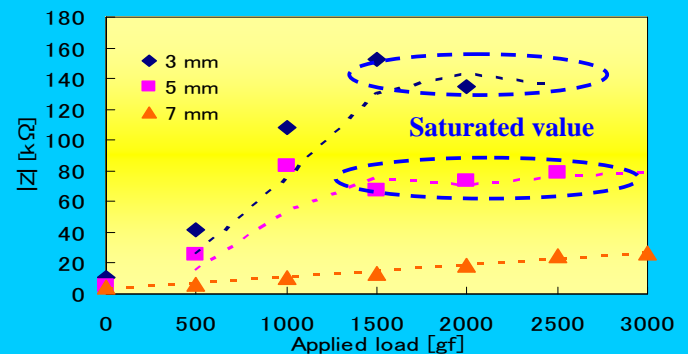
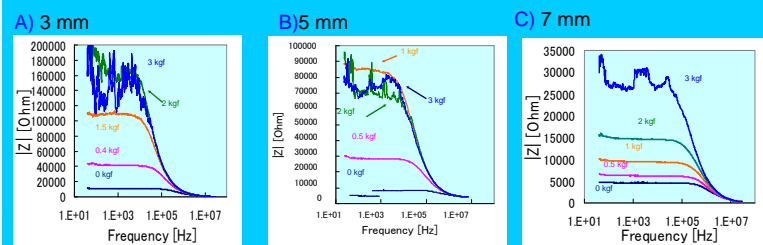
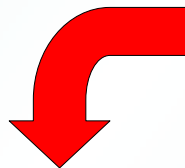


Fig. 2. Dependence of  $|Z|$  for single layer sensor with different thickness as a function of applied load at 1 kHz

Improvement



## Double layer type

	Matrix	CMC length	CMC content [wt%]	Composite thickness [mm]			Applied load [gf]
Upper layer	Soft (GE Toshiba YE5623)	0.3-0.5 mm	7	3	2	1	0-3000
Under layer	Hard (Shin-Etsu silicones KE-103)			1	2	3	

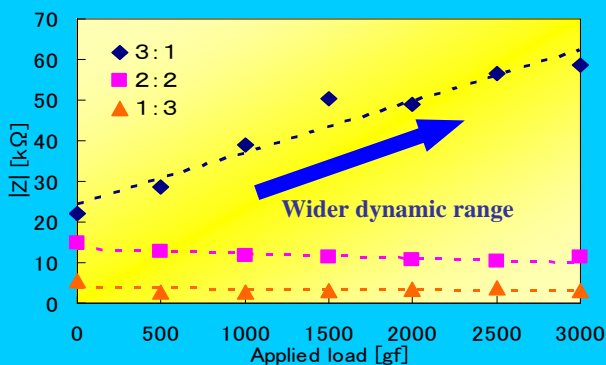
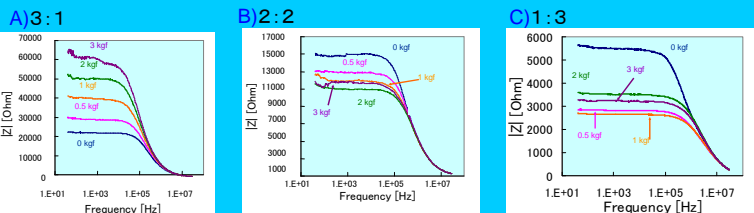


Fig. 3. Dependence of  $|Z|$  for double layer sensor with different thickness as a function of applied load at 1 kHz

## Conclusion

For widening the dynamic ranges...

The best composite thickness : **3-5 mm**

The best composite ratio :  
**soft(upper)/hard(under)=3/1**

The CMC tactile sensor can detect the applied load of **0-3000 gf**.