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利用形態　:機器利用
利用課題名(日本語)　:微小振動子振動特性の測定
Program Title (English)　:Vibration characteristics measurement for a microcantilever
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1. 概要(Summary)

This research is about a microcantilever covered with SnO_2 sensing gauge on the root of it. The microcantilever is aimed at measuring the gas concentration through the shift in its resonance frequency when the gas molecules are adsorbed onto the surface of it. SnO_2 is a kind of piezoresistive material, which can be applied as the sensing gauge of the microcantilever. Based on the circuit with SnO_2 sensing gauge, the vibration characteristics of the microcantilever can be attained. In this research, the microcantilever is fabricated by wet etching process. Before the evaluation for the SnO_2 sensing gauge, the vibration mode and the vibration characteristic of the microcantilever is confirmed and measured by a micro system analyzer through laser.

2. 実験(Experimental)

【利用した主な装置】

機械特性評価装置 Polytec MSA-500 振動解析装置

【実験方法】

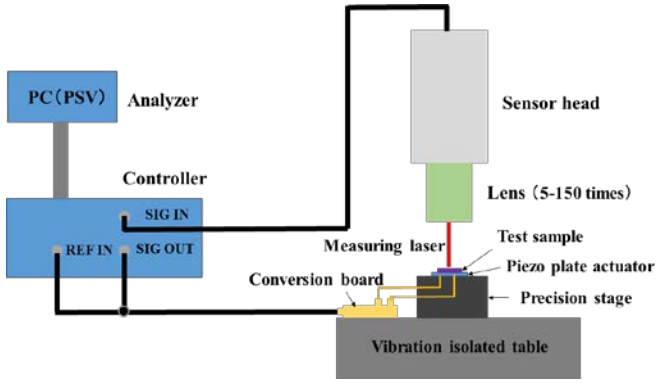

Fig. 1 Experiment setup of measurement

The test chip with microcantilevers fabricated on it is fixed onto a piezo plate actuator. The displacement of the microcantilever is attained by the laser while the actuator is excited by a chirp signal to find out the resonance frequency of the microcantilever. The experiment setup is shown in Fig. 1. The size of the measured microcantilever is shown in Fig. 2. The yellow part is B-doped Si cantilever part with 2 slits within it. On the root of the cantilever part is the SnO_2 sensing gauge which is marked blue in Fig. 2. The microcantilever is 80 nm in thickness.

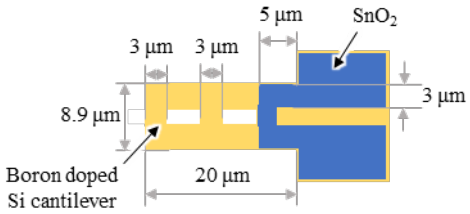

Fig. 2 Top view of the microcantilever

3. 結果と考察(Results and Discussion)

In order to exclude the vibration characteristics of the piezo plate actuator, both of the displacement of the SnO_2 part (nearby the root of the cantilever) and the microcantilever tip is measured and the vibration characteristics of the microcantilever is evaluated by gain, the displacement of the microcantilever tip divided by the one of the SnO_2 part. The result is shown in Fig. 3. After the calculation, the resonance frequency (1st mode) of the microcantilever is found to be around 369 kHz.

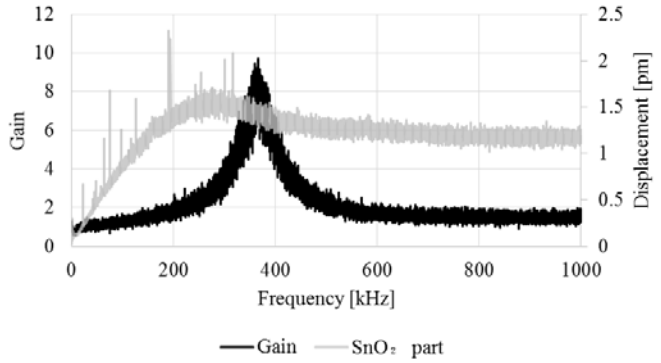

Fig. 3 Measured vibration characteristics

4. その他・特記事項(Others)

We would like to thank Associate Professor Yoshio Mita and his laboratory members for their extremely valuable suggestions for this research.

5. 論文・学会発表(Publication/Presentation)

(1) 方琦、上木瞭太郎、福井類、山口武司、佐藤真、越後谷天垣、三田吉郎、山田一郎、割澤伸一：SnO_2 薄膜によるガスセンシング性能とピエゾ抵抗特性評価 ; 2017 年度精密工学会春季大会, 2017 年 3 月 13 日

6. 関連特許(Patent)

なし