MODELLING OF STRESS AND OPTIMIZATION OF THE MANUFACTURING PROCESS OF SILICON NITRIDE MEMBRANES

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Keywords: Raman spectroscopy, PECVD, Stress/Strain, Silicon nitride thin films, Finite element method

ABSTRACT

As a part of the international fusion experiment ITER, a Danish company has been contracted to develop the sensing component of the bolometer diagnostics system. A schematic of the component as seen in Fig. 1 shows the silicon nitride membrane on a silicon substrate with a platinum meander resistor and a gold absorber layer. In previous work [1], a 0.8x0.5 mm and 2 µm thick silicon nitride membrane was fabricated in collaboration with Polyteknik AS. The silicon nitride thin film was synthesised with SiH_4 and NH_3 in a PECVD reactor and deposited onto a silicon substrate. The membrane was obtained by an anisotropic wet chemical etch with KOH as seen in Fig. 2. In this paper, effort is put into optimizing the fabrication procedure to reduce etching damage and to increase the size of the membrane. Raman spectroscopy is examined as a possible technique to qualitatively characterize stress in silicon nitride thin films and membranes since the stability of the membrane is correlated to the stress. The residual stress in the thin films and membranes, and the influence of the gold absorber layer are sought modelled with the finite element method.

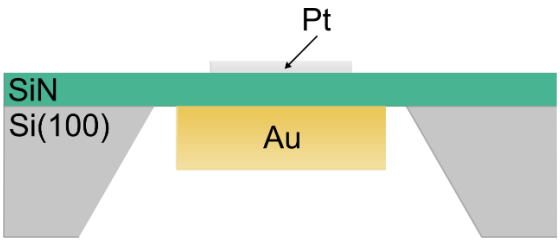

Figure 1: Bolometer sensor schematic.

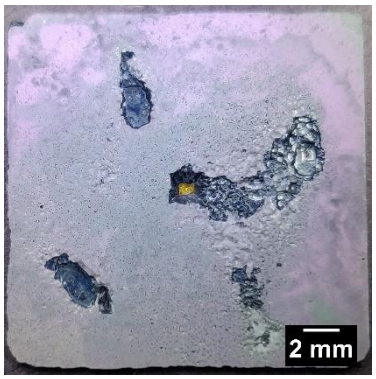

Figure 2: Silicon nitride membrane on Si.

Acknowledgement

The authors of this work gratefully acknowledge Grundfos for sponsoring the 8th MechMan symposium.

REFERENCES

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