THE STUDY OF HIGH AND LOW DOPED P-TYPE SILICON FIELD EMITTERS

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ABSTRACT

In this work, we present the results of our study on changes in occurrence of fields emission phenomenon depending on the amount of dopant in silicon wafer used in the emitter making process. Saturation level of current which appears in p-doped silicon field emitters [1] could be used to improve stability of generation of electrons in electron beam, which in term could result in better performance of electron microscopes. Analysing the influence of amount of dopant on the field emission phenomenon could open up new possibilities of designs and implementations of field emitters in vacuum MEMS electron devices [2]. Silicon tips were manufactured from both high (boron, 0.001- and low (boron, 10- doped p-type silicon wafers. In the process of making tips we used anisotropic silicon etching was used in aqueous solution of potassium hydroxide as well as photolithography using specially designed mask in order to increase the height to width ratio of the emitter [3]. The pyramids were used to induce and measure field emission in vacuum environment, taking into special consideration the voltage required for this phenomenon to happen and for a stable emission of electrons. In order to have a thorough comparison the experiment was repeated for n-type silicon wafers, same technological processes and measurements methods were used in order to replicate the environment of the first experiment. The results indicate significant differences in both the amount of voltage needed for a field emission phenomenon to happen between p-type wafers with different amounts of dopants as well as significant difference in the amount of time needed for wet etching.

0.005 Ω·cm)
20 Ω·cm)

References

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