

論文 / 著書情報
Article / Book Information

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| 題目(和文) | |
| Title(English) | SELF-TERMINATED NANOGAP ELECTRODES BY ELECTROLESS GOLD PLATING |
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| Category(English) | Doctoral Thesis |
| 種別(和文) | 論文要旨 |
| Type(English) | Summary |

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

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| 専攻 : Department of | 材料物理学 | 専攻 | 申請学位 (専攻分野) : Academic Degree Requested | 博士 Doctor of | (Engineering) |
| 学生氏名 : Student's Name | Victor Serdio | | 指導教員 (主) : Academic Advisor(main) | 真島 豊 | |
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

This thesis consists of 7 chapters that are divided into 4 parts. Part 1, "The introduction" consists only of the "Chapter 1. The principles". In this chapter the motivation of our research was first explained. After this, we reviewed some important facts and the actual state of technology involving the molecular electronics. Single-electron transistors are one of the main structures that are elaborated by the nanogap electrodes structures; therefore its basis was also reviewed. In order to understand further topics discussed in this thesis the background of the nanogap structure and a comparison of the different fabrication techniques was also elaborated. For our fabrication process we use the surface-catalyzed electroless gold plating process, thus a wider explanation of this technique, compared to the other, was carried out.

The Part 2 of this thesis consists of three chapters, one for each of fabrication techniques that were studied and developed during the Ph.D. course. We start in "Chapter 2. Nanogap electrodes template fabrication", in which the top-down processes of electron-beam lithography and photolithography explained in order to develop the initial templates of nanogap electrodes. These samples will be later subject of the bottom-up processes in the following two chapters.

"Chapter 3. Electroless gold plating" is when we start to discuss the bottom-up processes of the nanogap fabrication with the Iodine based EGP. This particular technique already has an evolution history of over 5 years, which has enabled us to obtain very good results and yields of functional nanogaps of 95.55%. Every step will be explained and the differences that have allowed us to improve the yield and activation of the self-termination mechanism out from the previously established process by Yasutake et al. in 2007.

The last chapter of Part 2 is "Chapter 4. Molecular ruler electroless plating". Here, the second of the bottom-up techniques of nano structures fabrication of nano devices is explained. In these plating techniques, a plating solution containing surfactant molecules is used. The function of these surfactant molecules is to limit the growth of the gold plating layer in the nanogap region due to their electrostatic bonding to the electrodes' surface. Two sub-techniques will be explained, nanogap ruling based on "Interdigitation" and "Interlinking".

The Part 3 of the thesis is when we get into a further study of the nanogap structure and its utilization for functional devices. We start in "Chapter 5. The nanogap structure" in which detail study of the nanogap structure based on Focus-ion beam is presented. This technology enabled us to characterize the nanogap electrodes in a cross sectional interface changing our misconception of it.

Following in "Chapter 6. Single-electron transistors" we studied how these nanogap electrodes, with the incorporation of nano particles to act as Coulomb island, can yield functional electronic devices. Their fabrication and operation will be explained.

In the Part 4, the final notes are made in "Chapter 7. Conclusions". We will finish by summarizing the achievements and results of the experiments.

備考 : 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).