Removing Pt contamination in FIB assisted deposition of electrodes for nanodevices

Y.L. Li , J.J. Li , A.Z. Jin , Q. Luo , C.Z. Gu
Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, P.O.Box 603, Beijing 100190, China.
Tel&Fax: 86-01-82548197, E-mail: czgu@aphy.iphy.ac.cn

Nanodevice research and development, whether they are based on nanotubes, or nanowires or quantum dots, require a good interface to the external world. The most common interface is electrodes which connect the nanstructures to external measurement instruments. Electrodes can be deposited by electron beam or optical lithography and lift-off of metal thin films. However, the most flexible technique that can quickly deposit the electrodes is focused ion beam (FIB) assisted deposition of tungsten or platinum, with platinum being favoured because of its inertness [1,2]. Although FIB has very fine probe size and accurate landing position on a substrate, the platinum atoms that are dissociated from metal compound gas are not landing exactly at the pattern area that defined by a FIB probe. Stray Pt atoms can deposit outside the electrode area, causing deterioration of surface conductivity between two electrodes, which can create false measurement for the study of a nanodevice. So far, there are few discussions about the issue of Pt contamination during FIB assisted deposition, and the elimination of Pt contamination has rarely been reported.

In this work, we reported the results on Pt contamination during FIB assisted deposition of Pt electrode pair and the way to remove this contamination. A proper Pt-electrode interspace and thickness were obtained while a gentle reactive ion etching is used to remove the effect of Pt contamination on the measurement, and then local surface conductivity of diamond film was tested using Pt electrode pair as an example. Fig.1(a) shows SEM image of a as-deposited Pt electrode pair for the measurement with contacting double probes, and Fig.1(b) and (c) give the dependence of the surface conductivity on the interspace distances between two Pt electrodes and electrode thickness. The effect of Ar plasma etching to remove the Pt contamination on the surface conductivity between two Pt electrodes was shown in Fig.1(d), which indicates that a proper etching duration can eliminate effective the influence of Pt contamination. Furthermore, as an example, the local surface conductivity of diamond film was surveyed via FIB assisted deposition of Pt electrodes and Ar reactive ions etching to clean the contamination. The results indicate that above process is a very effective way to remove Pt contamination in FIB deposition electrode and obtain real measurement data.

---

[1] H.Komano, H.Nakamura, and T. Takigawa, J. Vac. Sci. Technol. B 9, 2653(1991).
[2] A.Tseng, J. Micromech. Microeng. 14, R15 (2004).

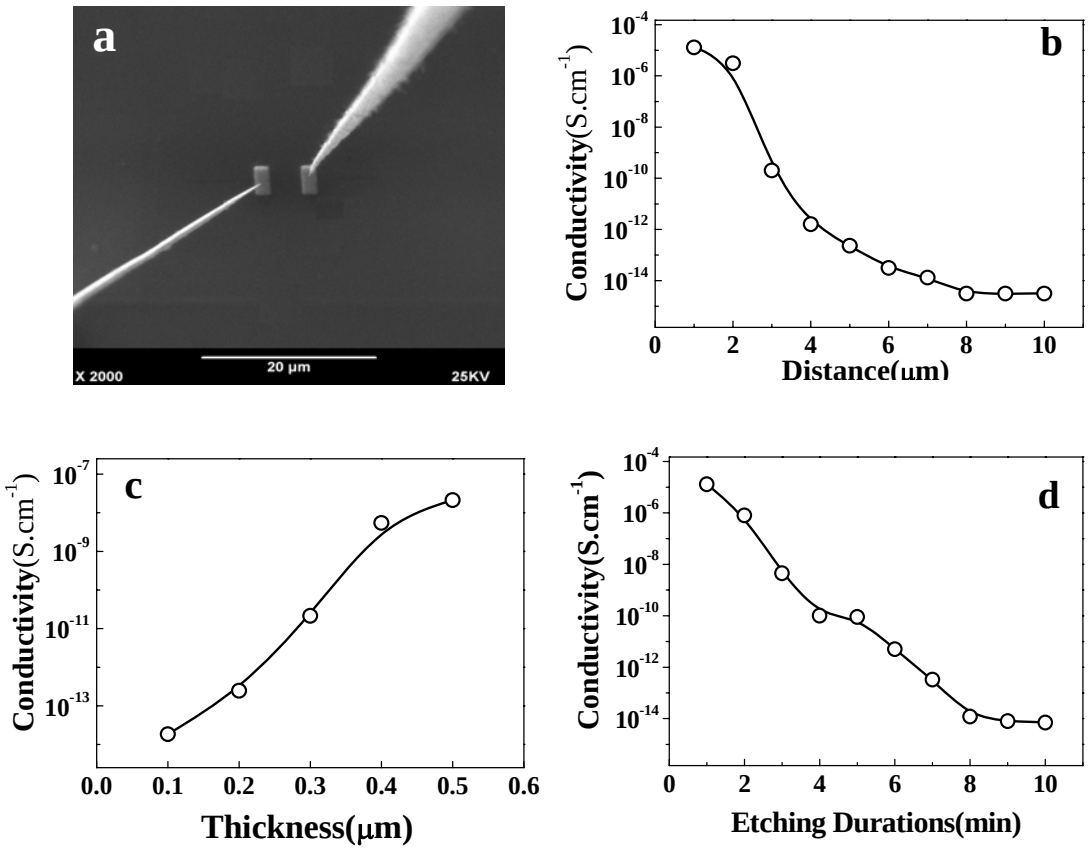

Fig.1 SEM image of Pt electrode pair with double probes contacting (a) and the dependence of surface conductivity between two Pt electrodes on the distance (b), thickness (c) and Ar plasma etching duration (d).