Comparative study of MOCVD Platinum thin films obtained by the use of liquid injection system or a conventional bubbler

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Materials for ferroelectric random access memories (FRAMs) are intensively studied for use in nonvolatile memory applications. Promising ferroelectric compounds deposited by MOCVD (Metal Organic Chemical Vapor Deposition) for FRAM capacitors include (Ba,Sr)TiO_3 (BST) and Pb(Zr,Ti)O_3 (PZT). For the application of such materials, deposition techniques for suitable electrodes must be developed. In particular, the MOCVD technique allows good conformal electrode films to be obtained, that are required to achieve high level of device integration density.

The integration of ferroelectric thin film capacitors onto silicon oxide demands a stable metallization due to the high processing temperatures encountered in the elaboration of ferroelectric films. Owing to its low electrical resistivity, excellent stability at high temperature and robustness against oxidation processes, the utilisation of Pt deposited by means of MOCVD as ferroelectric bottom electrodes is of current interest [1]. However, we have found a lack of adhesion associated with the use of platinum electrodes deposited by MOCVD on silicon oxide (SiO_2) in a previous work [2]. Hence, in order to improve the platinum film deposition, an adhesion layer consisting of TiO_2 thin layer was deposited onto SiO_2/Si substrates by MOCVD.

During this present study, we have deposited MOCVD Pt films from the precursor $MeCpPtMe_3$ in close experimental conditions by employing two precursor delivery techniques: (1) a TriJet™ (JIPELEC InJect) liquid delivery system and (2) a conventional bubbler.

The evolution of Pt film thickness, resistivity, texture, morphology and surface roughness with the main process parameters was investigated. The platinum films deposited onto TiO_2/SiO_2/Si substrate were always adherent, bright and reflective. On the figures 1-3, we can see respectively some examples of results from XRD (X-ray Diffraction), SEM (Scanning Electron Microscopy) and AFM (Atomic Force Microscopy) analysis. We have found close properties of the Platinum films deposited by the two precursor delivery system (Injector and Bubbler). The advantages and the inconvenient of each precursor delivery system for the deposition of Pt thin films are also highlighted.

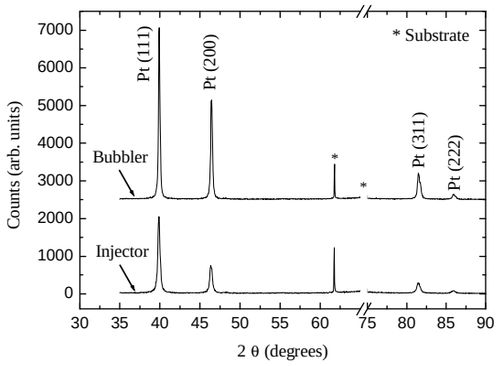

Figure. 1: X-ray patterns of Pt films deposited onto TiO_2/SiO_2/Si substrates

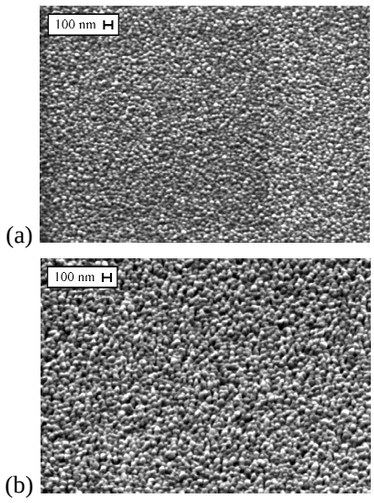

Figure 2. SEM micrographs of Pt films deposited onto TiO_2/SiO_2/Si substrates: (a) Injector and (b) Bubbler

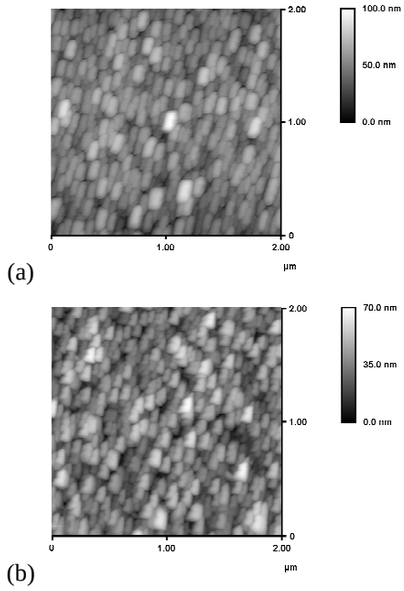

Figure 3. AFM topographic pictures of Pt film surface deposited onto TiO_2/SiO_2/Si substrates: (a) Injector and (b) Bubbler

REFERENCES

1. J.-H. Kwon, and S.-G. Yoon, *J. Electrochem. Soc.*, **144**, 2848, (1997).
2. O. Valet, P. Doppelt, P.K. Baumann, M. Schumacher, E. Balnois, F. Bonnet, and H. Guillon, *Microelectronic Engineering*, **64**, 457 (2002).