Structure and Damage of Silicon Modified by Means of Thin Films Ion Assisted Deposition

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Metal-silicon interaction is investigated intensively because of its great importance for electronic devices fabrication. In our work we have fabricated Me/Si structures (Me=Ti, Co) by method which we called self-ion assisted deposition (SIAD) technique and have investigated composition, surface topography and damage of silicon during process of SIAD. Titanium and cobalt layers were deposited on (100) oriented silicon wafers using a resonance vacuum arc ion source. Substrate, silicon wafers, were floated to a negative potential with respect to the source of 7 kV to accelerate the ion species. The composition of the deposited films and radiation damage of silicon were investigated using Rutherford Backscattering Spectroscopy and Channeling of He^+ ions with E_0=2,0 MeV. RBS data for concentration against depth were compared with data from the RUMP code simulation. The surface roughness and topology of modified surfaces were measured with an atomic force microscope NT-206 in scan area of 4x4 or 5x5 μm^2. We have shown that coating deposited on silicon include not only metal atoms but also carbon, oxygen, hydrogen and silicon (from substrate). The defects in silicon generated by irradiation with He^+ ions are concentrated near the thin film and Si substrate interface similar the experiments with 3 kV Ti SIAD [1]. But generally it is shown that damage of substrate depends on the procedure of Me/Si structure preparation. The coatings on silicon are characterized by uniform smooth surface.

References

[1] Tashlykov I.S., Wesch W., Wendler E.: Composition of thin C, Ti, Zr and Mo-based layers fabricated on Si by means of SIAD and accompanying radiation damage of Si surface, Proc. of III Internnational Symposium New Electrical and Electronic Technologies and their Industrial Implementation. Zakopane, Poland, May 13-16, 2003, p. 198 – 200