EFFECT OF NITROGEN PARTIAL PRESSURE ON REACTIVE MAGNETRON SPUTTERING FROM $Ti_{13}Cu_{87}$ METALLOID TARGET: SIMULATION OF CHEMICAL COMPOSITION

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S u m m a r y

A sintered $Ti_{13}Cu_{87}$ composite target was reactively sputtered in Ar–N_2 gas mixtures, and sputtered species were deposited on Si (111) substrates. We study the pressure-dependent target mode variation of the $Ti_{13}Cu_{87}$–N_2 system, by measuring the N_2 partial pressure, deposition rate, target voltage, and Ti and Cu concentrations for various reactive N_2 gas flow ratios. The $Ti_{13}Cu_{87}$ target surface begins to be nitrided with increasing N_2 flow ratio, which is caused by the absorption and the implantation of N_2 gas on the $Ti_{13}Cu_{87}$ target surface. Hence, the deposition rate was reduced due to the lower sputtering yield and a higher scattering under the mass transport between the target-substrate spacing. Secondary electron emission yield of the nitride portion of target surface is higher than that of the unnitrided portion. Therefore, at a constant sputtering power, the target voltage decreases, as the N_2 partial pressure increases. By means of the TRIM.SP Monte-Carlo simulation, the particle reflection coefficients of reflected neutrals was calculated. The initial energies of reflected neutrals and the sputtered particles at the substrate were estimated using the simple binary collision model and the distribution-weighted averages, respectively. Their final energies depend on the energy dissipation during the mass transport through the gas phase. The energy and angular characteristics of the sputtering yield were extracted from the available literature to obtain a prediction about a final composition of films.