ION-BEAM SURFACE REDUCTION OF METAL HIGHER OXIDES

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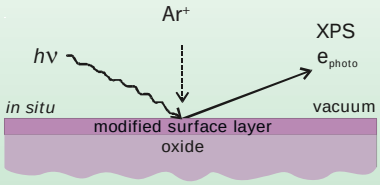
AIM

Investigation of surface modification of bulk samples of higher oxides MoO_3, WO_3, Nb_2O_5, Ta_2O_5 under low-energy Ar^+ ion bombardment and in situ non-destructive determination of chemical composition of modified surface layers by X-ray photoelectron spectroscopy.

EXPERIMENTAL



Dose $D = 10^{15}$–5×10^{17} cm^{-2}
Irradiation time t = 0.5–60 min
Ion current I = 10 μA
Energy E = 3 keV
Angle of ion incidence α = 90°
Room temperature
Pressed powder oxide samples of high purity

RESULTS

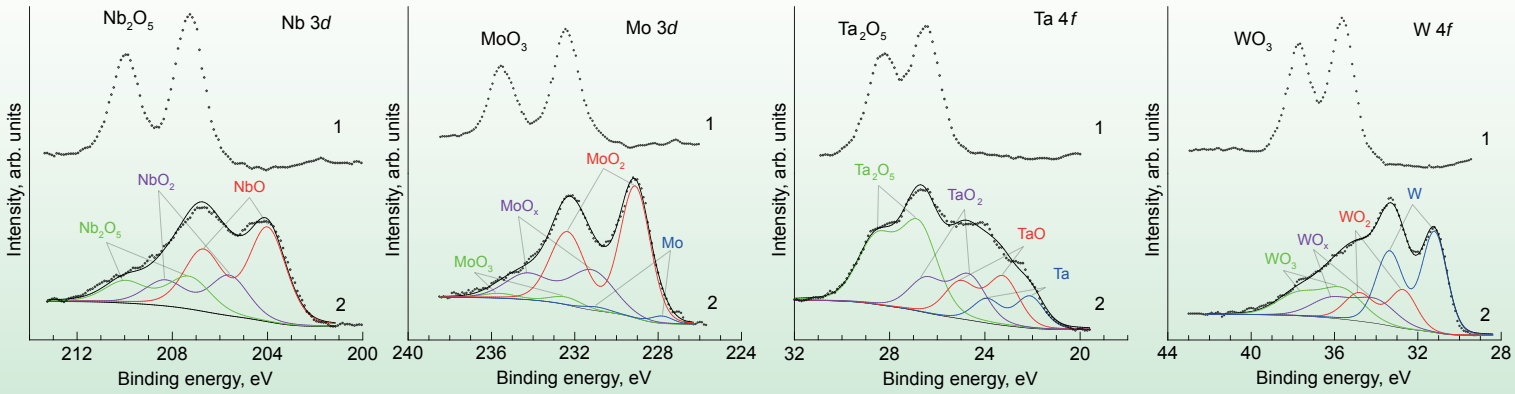
The irradiation of MoO_3, WO_3, Nb_2O_5 and Ta_2O_5 by low-energy Ar^+ ions induces the surface reduction and the formation of modified layer consisting of MoO_x, MoO_2, Mo; WO_x, WO_2, W; NbO_2, NbO and TaO_2, TaO, Ta, respectively.

The surface of Nb_2O_5 is reduced weaker than the surface of MoO_3 and the surface of Ta_2O_5 is reduced weaker than the surface of WO_3 under the irradiation by low-energy Ar^+ ions.

The surface metallization degree of oxides increases dramatically in row Nb_2O_5 (0 %) → MoO_3 (2 %) → Ta_2O_5 (12 %) → WO_3 (44 %) for 3 keV Ar^+ ion bombardment.

The ion-beam induced changes in oxide surface composition should be taken into account during the surface cleaning, depth profiling and analysis by SIMS and ISS.

X-ray photoelectron spectra of metal core levels of higher oxides and Ar^+ ion-beam modified oxide surfaces



1 — surfaces of virgin higher oxides; 2 — surfaces of higher oxides after Ar^+ ion bombardment (E = 3 keV; $D \approx 3\times10^{17}$ cm^{-2})

Dose dependencies of chemical composition of Ar^+ ion-beam modified oxide surfaces from XPS data