Investigation of thermal stability of Al-Mo thin films

J. Ivkov[1], N. Radić[2], K. Salamon[1] and **Marija Sorić**[1,3*]

[1]Institute of Physics, Zagreb, Croatia
[2]Ruđer Bošković Institute, Zagreb, Croatia
[3]Faculty of Textile Technology, Zagreb, Croatia

*msoric@ifs.hr

The thin Al_xMo_{100-x} films ($90 \leq x \leq 30$ with x in steps of 5 at% Al) were prepared by magnetron codeposition at room temperature. The films were prepared on alumina, glass and saphire substrate. The film thickness was about 400 nm. The as-deposited films were amorphous for $45 \leq x \leq 85$, as revealed with the grazing incidence X-ray diffraction (GIXRD) method. The films were first investigated by measuring the changes of the electrical resistivity with temperature, $\rho(T)$, during the isochronal heating. The dynamical temperatures of crystallization, T_x, were determined from the sharp increase of the derivative of ρ with respect to temperature. No systematic dependence of T_x on film substrate has been observed. The temperature of crystallization has a maximum around 530°C for x = 55 and 60, what is not very large for amorphous transition metal based alloys.

Electrical resistivity of both amorphous and crystallized films shows a strong dependence of electrical resistivity on alloy composition with a maximum for $Al_{75}Mo_{25}$. The resistivity of $Al_{75}Mo_{25}$ is 1000 μΩcm and 3000 μΩcm in amorphous and crystallized film respectively with the large negative temperature coefficient of resistivity of -10×10^{-4} K^{-1} and 14×10^{-4} K^{-1} respectively.

The evolution of the crystalline structure in Al_xMo_{100-x} films during heating was determined by measuring GIXRD after annealing each film at preselected temperatures. For $80\leq x\leq 90$ we found $Al_{12}Mo$ (x=90), Al_5Mo (x=85) and Al_4Mo (x=80) Al-rich intermetallic compounds, while for $40\leq x\leq 75$ a coexistence of Al_8Mo_3 and $AlMo_3$ phases was found with the fraction of $AlMo_3$ phase increases as x decreases.