THE PLASTICITY INDEX OF THE ”SOFT-FILM/SOFT-SUBSTRATE” COATED SYSTEMS

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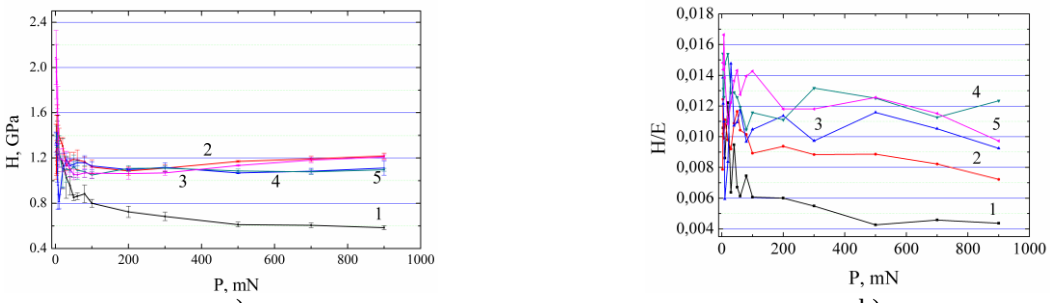
The advanced devices from the last years contain thin films deposited on substrates of materials with different properties, thus forming coated systems (CS) of film/substrate type. Scientists, as well as engineering staff are increasingly interested in knowing the mechanical properties of CS used in micro- and nanoelectromechanical systems [1].

In this paper, we investigate CS of the type „soft-film/soft-substrate” – *Cu/LiF* with different thickness of films: nanometric (t_1=85 nm), submicronic (t_2=470 nm) and micrometric (t_3=1000 nm), obtained by the magnetron sputtering method. The mechanical properties of the CS mentioned above were investigated by using the nanoindentation (NI) tester equipped with a trihedral diamond Berkovich pyramid as an indenter [2]. Along the hardness (*H*) and Young's module (*E*), the mechanical properties of CS are also characterized by the *H/E* ratio called "plasticity index" [3]. We show that for the studied materials, the values of *H* and *H*/*E* change with the P_{max} load increase. We show these dependences in Fig. 1.



a) b)

Fig. 1. Dependencies reflecting the variations of the hardness (*H*) a) and plasticity index *H/E* b) of the load P_{max} value in the range (5±900) mN at NI tester for all CS *Cu/LiF* and monolithic crystals. The respective curves are characterized by: 1 – the polycrystal *Cu*, 2 – the single crystals *LiF*, 3 – *Cu/LiF*, t_1=85 nm, 4 – *Cu/LiF*, t_2=470 nm, 5 – *Cu/LiF*, t_3=1000 nm.

From Fig. 1a) one can see that the *H(P)* CS dependences have the form similar to the hardness *H(P)* of the *LiF* substrate, however, they have higher values compared to the polycrystalline *Cu*.

The values of the plasticity index, *H/E*, of the CS (Fig. 1b) demonstrate the higher values compared with materials used for the creation of these structures that indicates their higher resistance to plastic deformation.

Keywords: *coated systems, nanoindentation. mechanical properties, plasticity index.*

References

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