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Relaxation Parameters of Cu/substrate Type Coated Systems Under Nanoindentation

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Abstract

In this work, we studied the relaxation parameters, h_e - p and h_{res} , of three composite structures Cu/LiF, Cu/MgO, and Cu/Si, which have different types of a chemical bond between the substrates (ionic (LiF), ionic-covalent (MgO), and covalent (Si)) and differ in hardness ($H_{Cu} = 0.6$ GPa, H_{LiF} , H_{MgO} and H_{Si} are 1.2, 7.5 and 8.2 GPa, respectively). For each type of substrates, coated systems (CSs) were fabricated with a following Cu film thickness: $t_1 = 85$; $t_2 = 470$ and $t_3 = 1000$ nm. The behavior of relaxation parameters was examined over a wide range of loads, $P = 2-900$ mN, during nanoindentation. The elastic-plastic parameters were shown to depend on the CS type, as well as on the film thickness and the magnitude of the applied load.

Keywords: nanoindentation, relaxation parameters, composite structures, coated systems, nanoindentation, films

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