Itin plonų chromo dandų optinių savybių tyrimas

A study of ultrathin chromium films‘ optical properties

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Structural, optical, and electrical properties of ultrathin chromium films manufactured using magnetron sputtering were investigated. The films showed pure metallic chromium phase yet their refractive index and extinction coefficient result very different from previously reported in literature. Structural, electrical and optical properties of ultrathin chromium layers are discussed in detail. The obtained optical constants of ultrathin chromium films show a specific trend with the film thickness increase. Precise knowledge of optical constants of ultrathin chromium films is important for many electro-optical and optical applications.

Ultrathin metal films are widely used for optical applications, and in particular when deposited on dielectrics like glass or fused silica. The initial growth stages of ultrathin films are well known for non-linear changes in optical and structural properties of the films. The process of metal film growth on dielectrics has three stages: the formation of initial seeds and islands, the coalescence and the continuous stage. It is well known that at the initial stage, small isolated islands of metal start to form three dimensional islands on the dielectric substrate. The balance between the substrate surface energy and the energy of sputtered species determines the wetting angle of the formed islands. Hence, the type of the film growth, either Volmer-Weber[1] or Stranski–Krastanov mode. At the first stage, metal islands are not only transparent to visible and infrared radiation, but also their density remains constant. After percolation, three dimensional islands coalesce either keeping grain boundaries between them or fusing to form a boundary free island, depending on saturation and surface energies. The final continuous stage is described by the full merge of the islands and relatively insignificant change in the film reflectance and transmittance, as well in electrical and optical properties.

The aforementioned mechanisms of the film formation have been extensively studied for noble metals like Ag, Cu and Au, while for transition metals the available literature is extremely limited. Chromium is known for fast growth of ultrathin continuous films. Precise knowledge of the film properties and optical constants of ultrathin Cr may result crucial for many electro-optical and optical applications. In our recent paper,[2] the structural, electrical and optical properties of ultrathin sputtered chromium films were investigated and compared with literature data.

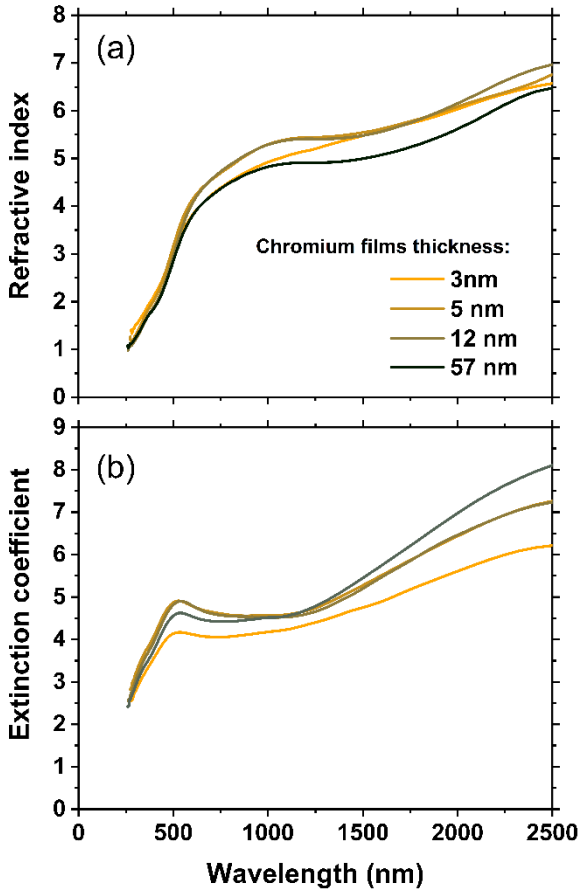

Fig 1. Optical constants of ultrathin chormium films.

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Literatūra

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