Dielectric function of metallic thin films obtained from optical transmission measurements

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Thin films of nanometric thicknesses have a very wide range of technological applications in the optics industry. To design thin film coatings it is important to understand the fundamental optical properties, such as the dielectric function, of the materials used. In nano-sized coatings there are effects due to nano-dimensions and to the texture and grain structure of the films. In this work, we determine the dielectric functions of metallic thin films and compare them with the corresponding bulk values. Films of Pd, Zr, Ti and In are deposited on fused quartz substrates in a high vacuum chamber by e-gun evaporation with thicknesses from 8 to 100 nm. Optical transmission is measured in the wavelength range of 240 to 1040 nm. From transmission spectra, by means of a Spectral Projected Gradient Method, the complex refractive index is extracted and from it the real and imaginary parts of the dielectric function are calculated. AFM images of each film were made to determine the grain size distributions. This grained structures are related to particular features found in the different thin films' dielectric functions considered.