ABSTRACT

Application of nanoindentation method in ultra thin films presents two major challenges (a) the determination of tip geometry (b) the substrate effect. For the determination of tip geometry we developed a new calibration technique for shallow indentation depth, using fused silica as a reference sample. On the other hand for the substrate effect, a novel method base on Finite Element Method simulations was created. These new techniques were applied on two types of ultra thin films (100nm), single layer titanium diboride (TiB_2) and multilayer titanium/titanium diboride (Ti/TiB_2). The estimated mechanical properties were correlated with changes in thin films nanostructure.

Moreover, nanoindentation was used for the in depth study of creep behavior of hybrid materials, used for the encapsulation of electrical circuits in flexible electronics. The generalized Kelvin-Voigt model was used for the estimation of materials viscoelastic properties, which were also correlated with materials barrier properties.