Electrical properties of Pd-ZrO_2 thin granular films prepared by RF Magnetron Sputtering

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Abstract

Nanostructures have been often studied in recent times due to their revelant basic properties and potential applications. In order to determine their unique properties which are displayed at the nanoscale regime. The behavior of single grains has been analyzed and there are some theoretical models which explain it, but the properties and behavior of a series of grains is rather complex. In particular, we have measured the tunneling differential conductances of Pd-ZrO_2 thin granular films prepared by RF Sputtering. We found that temperature dependence of G at zero bias $G(0,T) \propto \exp(-\sqrt{\frac{U}{K_B T}})$ reveals the presence of thermally assisted tunneling . The dependance of differential conductance on applied voltage shows a parabolic background which reveals the presence of elastic tunnelling at high temperature range (265-286K). Below $T \sim 234\text{K}$ a dip, superimposed to the parabolic background, develops and the increase of G(V) at low voltage is caused by the Coulomb blockade of tunneling. This can be described by the expression $G(V,T) = G(0,T) + T^{1/2} \times f(e|V|/K_B T)^{1/2}$.