Multifunctional Properties of (La,Ba,Sr)MnO_3/ZnO Heterostructures

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Unprecedented growth of digital electronics over the past 50 years has largely been driven by technological capabilities to reduce device dimensions. It is predicted, however, that as transistor dimensions reach the quantum regime, the scaling benefits would diminish [1]. In view of these trends, there is an urging need for novel systems, including nanoscale ones, with increased functional diversity and capability of self-adjustment. In this aspect, (La,Ba,Sr)MnO_3/ZnO heterostructures are of particular interest, since they display high versatility and demonstrate the properties easily tuned by external fields and light [2-4].

Doped manganese oxides (La,Ba,Sr)MnO_3 have been attracted great interest due to a high sensitivity of their electric and magnetic properties to external perturbations such as electric/magnetic fields, temperature, etc [1,2]. In a certain temperature range, these materials display *p*-type conductivity. ZnO is a *n*-type semiconductor with a direct wideband gap (3.37 eV) and large exciton binding energy (60 meV), which makes it a promising material for short wavelength low-power consuming light-emitting and laser diodes [2,3]. As a result of the combination of such properties, the (La,Ba,Sr)MnO_3/ZnO heterostructures display excellent rectification behavior, light sensitivity and resistive switching over a wide temperature range [2-5].

In this work, a fascinating physics of (La,Ba,Sr)MnO_3/ZnO heterostructures is reviewed and analyzed. A special attention is given to the results of the resonance measurements carried out on these (La,Ba)MnO_3/ZnO heterostructures grown on $SrTiO_3$ (001) substrate [5]. The conclusions are made about the role of various processes in the formation of peculiar properties of (La,Ba,Sr)MnO_3/ZnO heterostructures.

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