Properties and tunneling studies of the electron doped manganite $La_{0.7}Ce_{0.3}MnO_3$

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We report on structural, magnetic and electronic properties of the newly discovered phase $La_{0.7}Ce_{0.3}MnO_3$. This material is remarkably similar to $La_{0.7}Ca_{0.3}MnO_3$ which is well-known for its 'colossal magnetoresistance'. Most intriguingly, however, $La_{0.7}Ce_{0.3}MnO_3$ is shown to be an electron doped manganite in contrast to the Ca-containing material which is hole doped. Having electron and hole doped counterparts with otherwise similar properties opens up the possibility to a vast variety of new experiments as well as of technological applications. As an example, we report on magnetic tunneling devices which make use of the high spin polarization in the electrodes. An analysis of the I-V characteristics of such tunnel junctions leads to the conclusion that minority spin carriers prevail at the Fermi energy and Mn is in a intermediate spin state in $La_{0.7}Ce_{0.3}MnO_3$. The tunneling magnetoresistance is discussed in detail for the different temperature regimes investigated.