Current-induced conductance jumps in La$_{0.7}$Sr$_{0.3}$MnO$_3$ manganese point-contacts

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The conductance switching processes are studied as a function of the DC current (up to $10^8$ A/cm$^2$) passing through nanoconstruction of a mechanically controllable junction (MCJ). The current-voltage ($I-V$) curves of the MCJ are non-ohmic with a parabolic form of the differential conductance ($dI/dV$) versus the voltage, typical of an electron tunnelling process. By fitting of the $I-V$ curves to the Simmons theory the barrier width (1-1.6) nm and height (0.4-0.7) eV as well as the effective tunnelling area (1-10)$\times10^{-9}$ cm$^2$ were estimated for the junctions. We interpret the jumps in conductance of MCJ about integer multiples of $e^2/h$ as due to the configuration reorientation of the magnetization of the Mn-ions' clusters at the surface of the devices. This switching can be understood in terms of the exchange of angular momentum between the spin-polarized current and magnetic moments of the cluster situated between the electrodes or on their surfaces. Since the electron transmission through the barrier varies exponentially with thickness, most of the tunnel current flows through the thinnest part of the nanoconstruction.

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