Magnetocaloric Properties of Single Crystalline $YbTiO_3$ with Second Order Phase Transition

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Magnetic entropy change and refrigerant capacity in applied magnetic fields up to 5 T have been investigated in the temperature range of 10-90 K for the single crystalline $YbTiO_3$. The sample was prepared through the floating zone method. The maximal magnetic entropy changes at the second-order magnetic phase transition temperature T_C (∼42 K) are about 2.47 and 5.25 J kg^{-1} K^{-1} under 1.5 and 5 T, respectively. The magnetic entropy change is related to the sharp magnetization jump, attributed to the lattice parameters change just at the Curie temperature. The magnetic entropy change for $YbTiO_3$ can be well described by a phenomenological universal curve behavior. The field dependence of the magnetic entropy change can be expressed as $\Delta S_M = H^n$. At the Curie temperature $n(T_C) = 0.633$ for $YbTiO_3$ single crystal. The field dependence of the relatvie cooling power (RCP) can also be expressed as $RCP = H^{1+1/\delta}$. For $YbTiO_3$ single crystal $\delta = 4.95$. The theoretical analysis of the relation between $n(T_C)$ and the critical exponents suggests that the critical behavior of $YbTiO_3$ belongs to the Heisenberg model. This was also confirmed by the heat capacity and thermal conductivity measurement.