

## **PTCR effect in n-doped barium strontium titanate below 150 K**

**M. Viviani, M.T. Buscaglia, V. Buscaglia**

Institute for Energetics and Interphases, Dept. of Genoa, National Research Council, Via De Marini 6, 16149 Genoa, Italy

**A. Testino, L. Mitoseriu, R.V. Calderone, P. Nanni**

Dept. of Process and Chemical Engineering, University of Genoa, P.le Kennedy Pad. D 16129, Genoa, Italy

The d.c. resistivity of  $\text{Ba}_{(1-y)(1-x)}\text{Sr}_y\text{La}_x\text{TiO}_3$  ceramics with  $x = 0.0025$  and different values of  $y$  in the range 0.25-0.90 was measured between 10 and 400 K. Impedance spectroscopy was also carried out on selected samples. A resistivity anomaly corresponding to the PTCR effect was observed for all compositions. The onset temperature decreased from 320 K ( $y = 0.25$ ) to 70 K ( $y = 0.9$ ). The extent of the PTCR effect was significantly enhanced for the Sr-rich composition and reached 9 orders of magnitude for  $y = 0.9$ . Activation energy for conductivity was obtained from Arrhenius plots in the ferroelectric region and electron donor levels energy, calculated by the Heywang theory of the PTCR effect, was in the range 0.017-0.067 eV. When compared to the value for  $\text{BaTiO}_3$  (0.15 eV), these results show that donor activation energy significantly decreases with increasing Sr content. The feasibility of PTCR devices based on  $(\text{Sr},\text{Ba})\text{TiO}_3$  ceramics for application at cryogenic temperatures is confirmed.