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Pressure dependence of the large polaron transport in anatase TiO_2 single crystals JAĆIM JAĆIMOVIĆ, CRISTIAN VAJU, HELMUTH BERGER, ARNAUD MAGREZ, Laboratory of Physics of Complex Matter Physics, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland, VIKTOR CEROVSKI, RADOMIR ŽIKIĆ, Institute of Physics, Belgrade, Serbia, RICHARD GAÁL, LÁSZLÓ FORRÓ, Laboratory of Physics of Complex Matter Physics, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland — Anatase is a TiO_2 polymorph which is a 3.2 eV gap semiconductor interesting for several applications, including catalysis, photocatalysis, and, especially, dye-sensitized solar cells. Surprisingly, transparent single crystals of anatase grown in our laboratory show a metallic resistivity above 60 K which origin is a shallow donor level created by oxygen vacancies. The high value of the resistivity and its T^3 temperature dependence are the result of the polaronic nature of the charge carriers which is supported by the Seebeck coefficient (S). The application of hydrostatic pressure fails to close the donor level and to extend the conducting state to the entire temperature range. Instead, we have found a non-monotonic variation of the low temperature activation energy with applied pressure which is ascribed to the change of polaron's mobility. Thermo-electric power exhibits an unconventional temperature and pressure dependence shedding an additional light on the conductivity mechanism in this compound. The pressure dependence of S is governed by the transport of the large entropy associated with the polaron formation.

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