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Temperature depending studies of multiferroic $TbMnO_3$ by spectral ellipsometry and Raman scattering ILKA MAHNS, Institute of Applied Physics, University of Hamburg, Germany , M. BASTJAN, R. RAUER, G. NEUBER, B. SCHULZ, S. MUELLER, A. RUSYDI, M. RUEBHAUSEN, e 11, D-20355 Hamburg, Germany, D. N. ARGYRIOU, Hahn-Meitner Institute, Germany, M. KIM, H. BARATH, S.L. COOPER, Dept. of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign — $TbMnO_3$ has been studied in order to understand the orbital, structural, and magnetic structure as a function of temperature by Raman scattering and spectral ellipsometry. We present optical spectra, in which anomalies can be observed above and below the Néel temperature of 41 K. Below T_N, $TbMnO_3$ develops a complex magnetic structural phase. Another characteristic temperature of this material is $T_F = 28$ K. Below this temperature, $TbMnO_3$ develops a multiferroic state. From the ellipsometry data, we find a rearrangement of the spectral weight at 41 K. Raman scattering with an excitation energy of 1.91 eV shows Jahn-Teller mode changes below T_N. Below T_F we also detected a new ferroelectric mode at 128 cm^{-1}. In the ellipsometry data as well as in the Raman spectra we identify another critical temperature at $T^* \sim 150$ K. From our observations we can conclude that there is a strong coupling between the electronic and lattice degrees of freedom, which influence both the formation of the multiferroic state and the Jahn-Teller-distortions.

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