High Temperature Far Infrared Emissivity, Reflectivity, and X-ray Absorption of BiFeO$_3$ N.E. MASSA, LANAIS EFO-CEQUINOR, UNLP, La Plata, Argentina, L. DEL CAMPO, D. DE SOUSA MENESSES, P. ECHEGUT, CNRS-CEMHTI, Orleans, France, G.F.L. FABBRIX, G. AVELED, LNLS, Campinas, Brazil, M.J. MARTINEZ-LOPE, J.A. ALONSO, ICMM-CSIC, Madrid, Spain — We outline the temperature dependent lattice dynamics of BiFeO$_3$ from 4 K to melting by combining far infrared emissivity and reflectivity. The TO low temperature unstable phonon ceases softening at $\sim$400 K. We verified that higher than $\sim$700 K not only thermal fluctuations but also off-stoichiometry chemical disorder are taking place partially reducing long-range order. Strong overlapping, merging, and internal mode band smearing, suggest tripling in an idealized high temperature paraelectric cubic phase. X-ray absorption near edge structure (XANES) shows Fe$^{3+}$ turning into Fe$^{2+}$ while the Bi edge downshift suggests reduction under heating in a very complex configuration. Overall, our structural measurements reveal defect induced irreversible lattice changes in an environment lacking of long-range coherence. By contrast, far infrared wavelengths above $T_c \sim$1090 K do not show this local symmetry breaking only yielding three very broad bands as it would be, in a macroscopic view, if the cubic phase Pmcm ($Z=1$) is adopted. We do not detect an insulator to metal transition before melting.

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