

Abstract Submitted
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Vibrational Lifetimes and Decay Mechanisms of O-H Stretch Modes in Metal Oxide Proton Conductors GUNTER LUEPKE, ERIK SPAHR, College of William and Mary, LANLIN WEN, MICHAEL STAVOLA, Lehigh University, LYNN BOATNER, Oak Ridge National Laboratory, LEONARD FELDMAN, Rutgers University, NORMAN TOLK, Vanderbilt University — In proton conducting metal oxides, measurements of the O-H and O-D vibrational lifetimes show that proton transfer processes successfully compete with multi-phonon decay, in contrast to conventional semiconductors, such as Si or Ge, where the latter dominates. In perovskite KTaO_3 , the O-H stretch mode decays via a phonon-assisted proton-tunneling process involving the O-Ta-O bending motion. In rutile TiO_2 , the local oscillatory motion of the proton quickly couples to a wag-mode-assisted classical transfer process along the c-channel with a jump rate of >1 THz. The transfer rates in these oxides are 7 to 9 orders of magnitude larger than that due to thermally activated diffusion at room temperature which is significant for renewable energy applications of proton conducting oxides.

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