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Band Gap Narrowing in Nitrogen-Doped $La_2Ti_2O_7$ with Transient Absorption Spectroscopy for Hydrogen Generation BRANDON YOST, SCOTT CUSHING, NIANQIANG WU, ALAN BRISTOW, West Virginia University — Nitrogen doping was found to extend lanthanum dititanate's (LTO), $La_2Ti_2O_7$, absorption from 380 nm to 550 nm giving a promising 2.3 eV bandgap for solar water splitting. The increased band gap in conjunction with a lack of mid-gap trap states allows for visible light photoactivity. In this presentation, transient absorption spectroscopy with both a supercontinuum and a THz probe confirm N-doping creates a continuum of states slightly above the valence band (VB) of intrinsic LTO without harming carrier lifetimes. Lifetimes are measured for carriers excited from the VB to the CB as well as from the dopant continuum to the CB. The measured lifetimes reveal lifetimes that are comparable to intrinsic LTO due to the minimal density of mid-gap states introduced by the nitrogen dopant. The THz probe confirms the visible light excited carriers are mobile and not trapped by measuring frequency dependent conductivity. Further, by adding reduced graphene oxide (RGO) and gold nanoparticles to the N-doped LTO, carrier extraction is further increased, tripling hydrogen generation.

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