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Surface state of $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$ investigated by terahertz emission and visible second-harmonic generation techniques SOON-HEE PARK, S.Y. HAMH, J.S. LEE, Gwangju Inst of Sci & Tech, JOONBUM PARK, JUN SUNG KIM, Pohang Univ. of Sci & Tech — One of the key issues in three-dimensional topological insulators is to separate a response of the surface from the bulk to exploit novel spin-momentum-locked Dirac fermionic surface state, and $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$ is one of such materials having a negligible contribution of the bulk conduction. We investigate the surface state of $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$ single crystals by using terahertz emission spectroscopy and second harmonic generation techniques. We observed a clear distinction in the phases of emitted terahertz electric field and azimuth-dependent second harmonic intensity in different pieces of the sample, and found their clear correlation with carrier types which can be attributed to upward or downward band bending. We examined variations of such optical responses after the cleavage of the samples under different atmospheric environments, and discussed the time-evolution of the surface state particularly in comparison with previous results on n-type Bi_2Se_3.

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