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Photoluminescence characteristics of bulk hydrogenated anatase TiO2

This study investigates the optical characteristics of hydrogenated crystalline bulk anatase Titanium dioxide (TiO2) using temperature-dependent photoluminescence (PL). The incorporation of deuterium (D2) is achieved by annealing in D2 atmosphere at a temperature of 300 oC. Temperature-dependent PL measurements are performed under continuous wave-laser excitation from 5.5 K to room temperature. The low-temperature PL measurement reveals that the spectra are dominated by exciton emission at 3.368 eV, accompanied by several phonon replica. As the PL spectra of TiO2 often show a significant Stokes shift with a broad emission band centered in the visible spectral range, such sharp PL features for TiO2 are rare in literature. As these samples are hydrogenated and other vibrational spectroscopy studies have already been performed on a similar sample, the lines observed at 3.368 eV are tentatively assigned to an exciton bound to hydrogen at oxygen vacancies (HO). The line observed at 3.305 eV is stable up to a measurement temperature of 200 K and accompanied by a persistent set of phonon replica. It is tempting to associate this line with defect-related emission.
The corresponding exciton binding energies are calculated from the temperature-dependent PL and will be discussed in detail.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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