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Local structure study of BiVO4 incorporated with Fe and Mn investigated by X-ray absorption spectroscopy

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Mn and Fe-incorporated BiVO4 nanoparticles with different doping contents were synthesized via one-step sonochemical method. XRD results show the essential structure of monoclinic BiVO4 structure and secondary phases were clearly found in form of metal-based oxide as MnO, Mn3O4, Mn2O3 and Fe2O3 compounds suggesting the incorporation of Mn and Fe ions. In addition, the effect of higher Fe loading content into BiVO4 nanoparticles distinctly displays the gradually lower intensity of main peak affected by disorder of major phase structure of BiVO4 due to the amorphous phase of BiFeO3. UV-Vis DRS results show the absorption edge in visible range of all samples when loading Mn and Fe contents into pure BiVO4 exhibit obviously the red-shift in visible range suggesting the lower optical band gap of pure BiVO4. XAS results show that oxidation states of all elements correspond to Bi3+, V5+, Fe3+ and Mn2+/Mn3+ ions. Mn K-edge XANES spectra of all samples indicate that local atomic sites of Mn atoms would not replace in local site of either Bi or V site in BiVO4 crystal, confirmed by the simulated Mn K-edge XANES spectra using FEFF9 code. Fe K-edge XANES spectra of all samples suggest that local site of Bi and V site in BiVO4 crystal were not replaced by Fe atoms verified by the simulated Fe K-edge XANES spectra. EXAFS results evidently display that local atomic site of Fe atoms of all samples was formed to BiFeO3 in form of the amorphous phase verified by simulated and experimental XANES and EXAFS spectra.

Topics

Session A. Physics of condensed matter and spectroscopy

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