The effect of milling time on Structural, optical and Photoluminescence Properties of ZnO Nanocrystals

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Abstract:

The crystallite size of commercial ZnO nanocrystals was tuned from 22.5 to 13.8 nm by ball-milling technique. X-ray diffraction patterns of mechanically milled ZnO nanocrystals reveal that milled samples possess the wurtzite-type hexagonal structure of ZnO. Increasing milling time results in the decrease of crystallite size and reduction of lattice parameters due to a slight increase of internal compressive strain and dislocation density. Scanning electron microscope images demonstrate the appearance of large agglomerated particles with ambiguous edges due to large aggregation tendency with slight variation in the particle size at milling time 8 h. Analysis of the optical absorption spectra at different milling time indicates the blue shift of exciton absorption peak and optical gap photoluminescence spectra reveal that mechanical milling of ZnO NCs leads to quenching of emission intensity due to the creation of nonradiative centers via increasing thermal strain and mechanical deformation produced during the milling process.

Keywords:

ZnO nanocrystals Ball milling Photoluminescence quenching Optical absorption spectra Energy diagram

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