

Virsmaktīvo vielu ietekme uz ZnS:Cu nanodaļiņu struktūru un īpašībām

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Aktivētiem ZnS materiāliem piemīt izcilas optiskās un elektriskās īpašības, padarot tos par izciliem materiāliem maiņstrāvas (AC) plānslāņa elektroluminiscences ierīcēm, saules paneļiem, gaismas diodēm, lāzerdiodēm un citu luminiscences ierīču izgatavošanai.

Šis pētījums ietver nanokristālisku ar Cu-aktivētu ZnS materiālu hidrotermālu sintēzi, izmantojot divas virsmaktīvās vielas – heksadeciltrimetilamonija bromīdu (HTAB) un nātrija dodecilsulfātu (SDS), kā arī bez virsmaktīvās vielas. Sintezēto nanopulveru struktūra, morfoloģija un elementu sastāvs tika raksturots ar rentgenstaru pulvera difraktometriju (XRD), rentgenstaru absorbcijas spektroskopiju (XAS), skenējošās elektronu mikroskopiju (SEM) un enerģijas dispersīvo rentgenstaru spektroskopiju (EDX) metodēm, savukārt optiskās īpašības tika pētītas ar fotoluminiscences (PL) spektroskopiju.

Iegūtie rezultāti liecina, ka virsmaktīvās vielas pievienošana ļauj kontrolēt parauga morfoloģiju un novēroto fotoluminiscenci. Nanokristālu izmēri visos sintezētajos paraugos bija zem 20 nm. XAS rezultāti liecina, ka Cu joni aizvieto Zn jonus kubiskā cinka maisījuma ZnS struktūrā un tiem ir lokāli izkropļota kristāla apkārtnē.

The effect of surfactant on the structure and properties of ZnS:Cu nanoparticles

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Doped ZnS materials exhibit excellent optical and electrical properties making them a superior material for alternating current (AC) thin film electroluminescent devices, solar panels, light-emitting diodes, laser diodes, and other luminescent device designs and fabrication.

This study involves a hydrothermal synthesis of nanocrystalline Cu-doped ZnS materials using two surfactants – hexadecyltrimethylammonium bromide (HTAB) and sodium dodecyl sulfate (SDS) as well as without a surfactant. The structure, morphology, and elemental content of the synthesized nanopowders were characterized by X-ray powder diffraction (XRD), X-ray absorption spectroscopy (XAS), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDX) techniques, while the optical properties were studied by photoluminescence (PL) spectroscopy.

The obtained results show that the addition of a surfactant allows for controlling the morphology of the sample and the resulting photoluminescence. The sizes of nanocrystallites in all synthesized samples were below 20 nm. XAS results suggest that Cu ions substitute Zn ions in cubic zinc blende ZnS structure and have a locally distorted environment.

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