Nanocomposites and nanomaterials

Light emission in SiO_2:C and Al_2O_3:C nanocomposites

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Light emission properties of carbon incorporated silica and alumina nanopowders are analysed and discussed. Nanopowders have been synthesised by modification of surface of fumed silica (specific area 295 m^2/g) and fumed alumina (specific area 87 m^2/g) with phenyltrimethoxysilane followed by thermal annealing in pure nitrogen at temperature in range of 400-700 ^oC. It was demonstrated that incorporation of pyrolitical carbon in oxide nanopowder results in the development of broad band photoluminescence that covers spectral range from near-UV to near-IR both in silica and alumina based nanocomposites. PL of SiO_2:C and Al_2O_3:C nanopowders exhibited some common properties: emission spectra are composed by at list two bands, and relative contribution of the bands is strongly dependent on annealing temperature i.e. increase of annealing temperature results in quenching of UV band and enhancement of visible emission. Emission, excitation (including X-ray excitation) have been thoroughly studied along with structural characterization by FTIR. It is found formation of silica structural domains on the surface of Al_2O_3 nanoparticles after annealing. On the base of this finding it is suggested that similar PL properties of SiO_2:C and Al_2O_3:C is determined by similar nature of SiOC based structural sites in the materials. Origin of broad band tunable light emission is discussed in term of native defects in oxide nanohost and carbon based surface pyrolitical precipitates/agglomerates/clusters.

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