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酸化ナノシリコンと多孔ガラスにおける紫外発光と青色発光の連関性

Blue and UV Luminescence Properties of Oxidized Nanosilicon and Pure Porous Glass

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Nano-silicon, such as nanocrystalline Porous silicon (PSi) is of great interest in optoelectronics as it can emit visible light as a result of quantum confinement. Very efficient and stable red photoluminescence (PL) [1] has been obtained from PSi layers. Efficient blue PL and more importantly long-lived blue phosphorescence (T➔S_0 transition in Fig. 1) from partially oxidized PSi were also reported[2].

Various types of organo-silicate compounds have been shown to emit, in particular, white or blue phosphorescence[3], typically attributed to either carbon substitutional defects for silicon in the Si-O-Si network, or to surface species like NH groups or to OH groups[3].

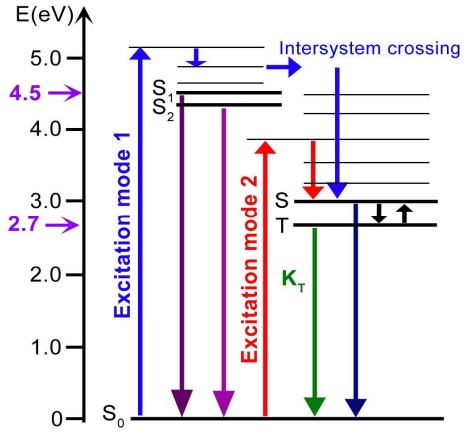

Fig. 1: Energy diagram showing two possibilities for the excitation of the blue phosphorescence: direct (mode 2) or indirect (mode 1). Different relaxation processes are also shown.

In order to understand further the mechanism of the long-lived blue phosphorescence observed in oxidized PSi (and the respective role of Si nanocrystals and oxide), we have done a comparative study of the luminescence properties of both pure porous glass and oxidized PSi. The two systems exhibit very similar luminescence characteristics. Furthermore, the blue band shows some correlation with another band situated in the UV spectral range and constituted of two sub-bands (related to S_1 and S_2 in Fig. 1). The implications for the light emission origin and mechanism will be discussed.

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