Advanced nanophosphor materials of different porosity for use in medical imaging

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Nanophosphors are a new class of advanced materials exhibiting unique structural and optical properties compared to those of their bulk materials mainly due to quantum size and surface effects originating from enlarging the band gap and widening the surface area with respect to volume of the bulk particles, respectively [1]. The utilization of nanophosphors has become ubiquitous over the past decade since they could replace existing phosphors for next generation, high-performance displays and devices and become a new realm of opportunity for scintillation technologies [2]. The scope of the present investigation was to examine phosphors of different porosity (or packing density- from 50% up to 90%) composed of grains with size in nanoscale (e.g., from 50 *nm* up to 100 *nm*). In particular, the variation of the optical parameters was evaluated (e.g., the light extinction coefficient as shown in figure 1) using Mie scattering theory and their effect on the optical diffusion capabilities though Monte Carlo simulation [3, 4]. Results showed that the packing density affects significantly the extinction of light. As a conclusion, powder nanophosphors of low porosity (high packing density) may: (a) improve the spatial distribution of light and thus detector's spatial resolution and (b) degrade the amount of emitted light and thus detector's sensitivity.

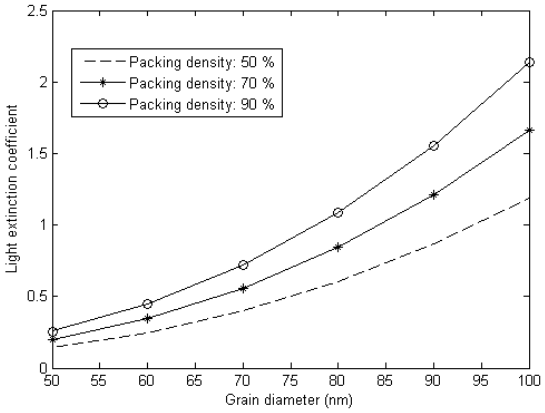

Figure 1: The variation of light extinction coefficient as a function of grain diameter (50 – 100 *nm*). Data are provided for three different values of packing density (50 %, 70% and 90 %).

References

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