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Application of nanostructured luminescent coatings for photodetection optimization

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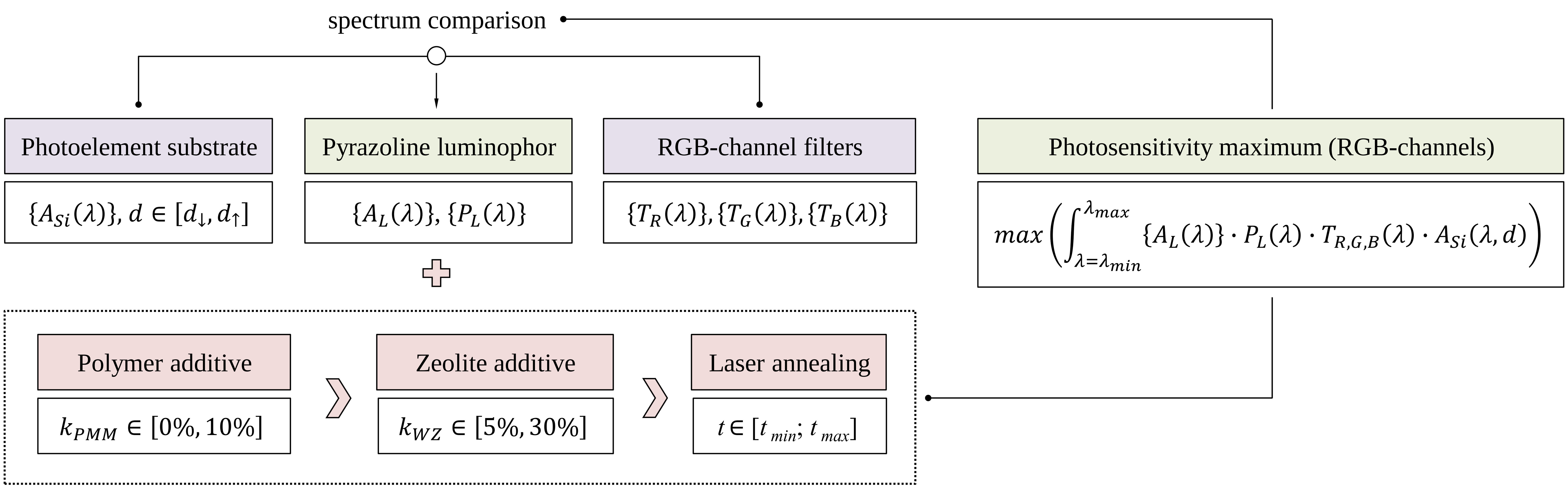
Introduction

The digitization of data has sparked a global trend, leading to the widespread use of digital photodetection tools. This shift has been accompanied by a drive for smaller, more affordable electronic devices, as well as advancements in digital data transmission, analysis, and storage systems. These developments have paved the way for new applications of digital photodetection tools across various domains, including industry, infrastructure design, logistics, medicine, social interactions, academic research, and the military-industrial complex [1]. After conducting thorough research, a comprehensive objective has been devised to improve the effectiveness of digital photodetection systems. This is accomplished by utilizing nanostructured photoluminescent coatings, which facilitate the synchronization of the photoelectric converter's absorption spectrum with the transmission spectra of the light filters, aligned with specific color schemes [2].

Methods and Results

Key factors influencing the system's performance include the photosensitivity of the photoelements and color balance. These factors are evaluated based on the photomatrix's color scheme, the optical characteristics of the photoluminescent coating, and the silicon substrate of the photoelectric converters.



Through the implementation of this methodology, the efficiency of the digital photodetection system can be significantly enhanced. The model compounds used for calculations were pyrazoline photoluminescent dyes [3]. The advantage of this set of luminophores is their high quantum yield of photoluminescence (QY = 75-80%), absorption in the near ultraviolet and visible ranges, and a sufficiently wide Stokes shift (115 nm to 280 nm). Control over the luminophores' characteristics (absorption spectrum and Stokes shift width) is achieved through the selection of the base dye and additives during the synthesis stage. Nanostructuring of the synthesized luminophor involves the incorporation of dye molecules into submicron and nanoscale pores of a white zeolite, followed by laser thermal annealing. This process, characterized by the amount of white zeolite relative to the total mass and the duration of the thermal annealing procedure, allows for an increase in the main photoluminescence peak by 5-11%.

Conclusion

Methodology for determining the optimal parameters of the photoluminescent coating layer on the elements of the photomatrix (with a silicon substrate for the photoelectric converters of the constituent elements) has been developed based on the target indicators of photosensitivity and color balance.

References

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