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Peculiarities of microfibrillated and bacterial cellulose luminescence properties

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Cellulose is the most abundant natural polymer, with great potential to replace plastics in various human activities, including packaging, textiles, and electronics. The eco-friendliness, biodegradability, and low production costs are among the main advantages of the cellulose-based materials compared to common petroleum-based polymers. Recent studies indicated that cellulose and its derivatives can also be used as functional materials in modern high-tech electronics and optoelectronics, e.g., wearable flexible sensors, solar cells, energy storage systems, and organic light-emitting diodes.

We report here the results of two types of cellulose materials'luminescence studies. The first type is Cotton Linter cellulose (commercial, purchased from Sigma Aldrich), which consists of microfibrils, and the second one is nanocellulose (produced by us), which was obtained through a bacterial process. It was found that both celluloses exhibit intense photoluminescence (PL) under PL excitation in the ultraviolet (UV) and visible spectral ranges (265–490 nm). In case of PL excitation at 265 nm, the PL spectra consist of several overlapping components with maxima near 331, 367, 407, 432, 494, and 577 nm, respectively. Although all these bands can be found in both of the studied celluloses, their relative intensities are different. This difference in the PL properties has been attributed to the distinct content of Ia and Ib cellulose phases in the studied samples. The PL kinetics studies have shown that each of the PL band consist of slow (milliseconds) and fast (microseconds) components, with increased contribution of the slow component for the long-wavelength emission.

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