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Photonic luminescent solar concentrators

By Johannes Gutmann

Fraunhofer Verlag Feb 2015, 2015. Taschenbuch. Book Condition: Neu. 241x148x20 mm. Neuware - Luminescent solar concentrators are semi-transparent plates that are able to concentrate incident sunlight on its edge faces, where solar cells are attached. This work studies how the dominant loss mechanisms of conventional devices can be mitigated by embedding the luminescent material in a photonic crystal to tailor its emission characteristics. In such a photonic luminescent solar concentrator emission is redistributed spectrally and directionally, which can strongly improve the guiding of light to the edge faces and thus increase the concentrator's efficiency. To quantitatively describe the effects of a photonic crystal on luminescent emission, new theoretical models are proposed in this work. This theoretical treatment provides significant physical understanding and insight in the interaction of light and matter, and is of large interest also for other applications that deal with the emission of light (e.g. LEDs, lasers). Furthermore, novel fabrication methods were developed to realize photonic crystals in form of Bragg stacks and opals with embedded organic dye molecules. Using dedicated photoluminescence measurements with angular resolution, an excellent agreement of calculations and experiments was found, which confirms the theoretical models presented in this work. 181 pp. Englisch.



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