# Using $Y_2O_3:Bi^{3+}$, $Yb^{3+}$ as down conversion phosphors to improve the power efficiency of solar cells.

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The theoretical maximum efficiency of a single-junction solar cell is specified using the Shockley–Queisser limit, of approximately 30%, for all single-junction cells. More efficient utilization of the short wavelength part of the solar spectrum can be achieved by the luminescent down-shifting (LDS) of the incident spectrum is a passive approach that can overcome the limitations. The application of an LDS layer was first demonstrated in the late 1970s to improve the poor spectral response of solar cells to short wavelength light. The LDS layer absorbs photons, typically in the 300-500 nm range and re-emits them at a longer wavelength, where the photovoltaic (PV) device exhibits a significantly better response. The LDS layer can help in harvesting full solar energy by expanding the operating spectral range towards the ultraviolet (UV) range. Detailed reviews of the progress in this area can be found in many literatures. Most previous research presented results for rare earth ions as candidates for the LDS (DC) process. $Bi^{3+}$,$Yb^{3+}$ codoped $Y_2O_3$ phosphor is promising for the enhancement of energy efficiency of c-Si solar cells as is reported by many researchers. Our motivation is to continue the investigation on $Bi^{3+}$,$Yb^{3+}$ codoped $Y_2O_3$ phosphor powder and thin film for possible application in solar cell as LDS layer. Some results of the investigations presented below: