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Light Energy (solar and luminescent materials) in Service of Man Kind - from Nanoscale to Microscale

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Abstract
Global economic development has lead to a rapid growth in energy needs. Climatic and geo-political risks associated with continued dependence on fossil sources require us to look at how we intend to address our energy needs in the future. Our long term goal is a transformation of the current fossil-fuel based energy system into a more secure, energy efficient, and sustainable one. Enhancing our knowledge of renewable energy sources through research and community engagement is an important step to achieve this goal of a sustainable energy mix. South Africa and Africa has a great potential for alternative energy sources. Unfortunately, none of these potentials are tapped in these regions for terrestrial applications. The driving force for this work is the realization that the traditional fossil energy resources such as coal, oil and gas are not only rapidly depleting, but also contribute to unpredictable and possibly irreversible climate changes in the near future through the high emissions levels of greenhouse gasses. Furthermore, the increasing concern for environmental pollution problems in industrialized countries has discredited nuclear power as long-term alternative energy concept. The population growth which is particularly large in rural areas, not connected to the electric world (3.0 billion worldwide), is another factor favouring the development of alternative energy industries.
Renewable energy (hereafter, RE) is being championed as a potentially significant new source of jobs and rural growth in several countries, and a means of addressing environmental and energy security concerns. In most countries, governments and utility companies have invested large amounts of public money to support RE development and are requiring significant quantities of it to be sold by energy providers. Therefore thin film (2nd generation) based solar energy is attracting significant attention as possible candidate for achieving drastic improvement in photovoltaic energy conversion efficiency. It is required to rule the energy sector when the breakeven of high performance is achieved and its cost becomes comparable with other energy sources. Various approaches have been intended to enhance the efficiency of solar cells. Applications of these thin films help us to solar devices more economically. Photovoltaic cells are used to improve the efficiency to create effective systems for conversion cost, efficient solar energy storage systems or solar energy on a large scale.

Key words: Solar cells; Luminescence; Water Purifications; Sensors, Up-conversions, Rare Earth, Phorphors