Project Idea for Joint Call 2023

Contact details

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Organisational profile

YTU Glass Research Group specializes in delving into the fundamental and applied facets of glass, unraveling its mysteries and harnessing its potential for transformative applications. Our multifaceted research delves into a diverse array of glass systems, including tellurite, antimonite, silicate, and phosphate compositions. These explorations serve as the bedrock for a wide spectrum of functional innovations, spanning domains such as energy, environment, and cutting-edge communication systems.

Our quest extends to the frontiers of glass innovation. We delve into the depths of heavy metal oxide glasses, uncovering their hidden potential as transparent large band gap semiconductors. Our exploration branches further to encompass sol-gel-based functional thin films, encompassing remarkable attributes like thermochromic behavior, anti-reflective prowess, and self-cleaning capabilities. Radiation shielding glasses, chemically strengthened ultra-thin glass, and luminous solar concentrators all fall within our purview, as does our pioneering work with lanthanide and quantum dot-doped glasses, igniting new pathways in LEDs, optical temperature sensing, and anti-counterfeiting applications. Our imprint is also felt in the captivating realms of 3D displays, solar applications, including Agri PV initiatives, and beyond. Further details about the group and its research activities can be found from www.glass.yildiz.edu.tr

What challenge area is our project idea focused on (topics according to guidelines):

CM 10A. R&I for clean energy integration in the built environment (ROA) (TRI7)
CM 10B. R&I for clean energy integration in the built environment (IOA) (TRI7)

Project idea

Luminescent solar concentrators (LSCs) step forward as a promising solution to increase the energy conversion efficiency of photovoltaic systems by decreasing the unit area of solar cells and increasing the number of useful incident photons. Lanthanide and/or quantum dot doped glass nanocomposites (GNCs) have a great potential to be used as alternative host/waveguide materials for LSC applications. In this project we aim to develop GNC-based LSCs and to evaluate their potential for practical applications in the built environment. With this aim, GNCs will be synthesized and coupled with solar cells (standard silicon cells and perovskite solar cells) in different configurations to construct LSC systems. Effect of LSCs on energy conversion efficiency of photovoltaic systems will be investigated and evaluated. Synthesis of GNCs and testing of different device configurations in GNC waveguides to increase optical performance of LSCs and their integration in building windows set the scientific quality and novelty of the project. The YTU Glass Research Group (www.glass.yildiz.edu.tr) and ODTU GUNAM Center for Solar Energy Research and Applications (https://odtugunam.org/)) bring a wealth of expertise in synthesizing GNCs, exploring and enhancing their photoluminescence (PL) characteristics, and integrating them into solar cells. This strong foundation will serve as a pivotal platform for evaluating these materials for LSCs.

We are looking for a partner from academia or industry to apply for this project together. We expect the partner to have expertise at least in one of the following fields

- investigation and/or evaluation of LSCs on energy conversion efficiency of photovoltaic systems
- integration of small/large scale LSCs to renewable energy technologies for BIPV applications
- production of GNCs in larger scale for building facades
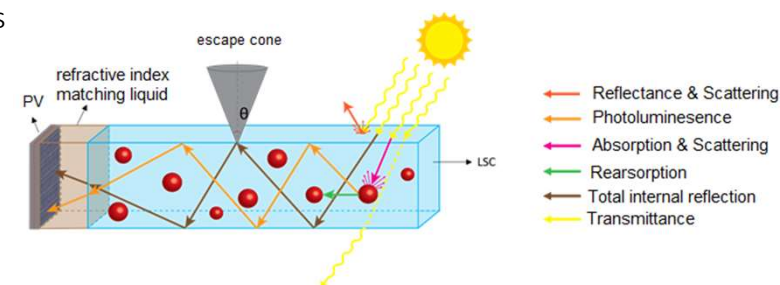
Figure: Schematic representation of combined LSC and solar cell using refractive index matching liquid

Concept Design of LSC for Windows

Perovskite solar cells

Refractive index matching glue

This glass piece will be inserted to a window frame

Special IR coating

Glass pane (window glass)

QD-embedded glasses (Luminescent glass color converters)