

## **Wearable luminescent solar concentrators employing amphiphilic polymer conetworks**

### **Abstract:**

Luminescent solar concentrators (LSCs) have attracted considerable attention in recent years for their advantages in absorbing diffusive light and increasing the cost-effectiveness of solar cells; however, the compatibility with flexible photovoltaics and the energy transfer (ET) efficiency still require improvement. In this thesis, amphiphilic polymer conetworks (APCNs) are employed as polymer matrices for wearable LSCs owing to their flexibility and wearability. Furthermore, with the assistance of APCNs' nanophase-separated hydrophobic and hydrophilic domains, hydrophobic and hydrophilic luminescent materials are loaded in adjacent nanometer-separated domains. This results in high ET rates and broadens the acceptor's absorption range, rendering a more efficient down conversion emission. With this straightforward synthesis procedure, we could achieve high ET rates between dye pairs via Förster resonant energy transfer (FRET) and photon recycling. These two energy transfer mechanisms were confirmed by steady-state and dynamic photoluminescence methods, showing a ~100% total ET between donors and acceptors.

Furthermore, APCNs LSC is applied to the flexible photovoltaics, fiber dye-sensitized solar cells (FDSSCs), to assist fully utilizing the advantage of harvesting light from all directions, enlarge the photon harvesting area, and recycle the lost photons. The prototype demonstrated in this work possessed a remarkable FDSSCs power conversion enhancement of 84% and a sustained efficiency even after 1000 bending cycles. This is the first showcase of the integration of FDSSCs and wearable LSCs as energy harvesting textiles for use in future wearable electronics systems. The novel use of APCNs could find potential in the energy-harvesting field, serving as wearable LSCs for the next generation of flexible and wearable photovoltaics.