세미나 초록

발표주제	Synthesis Design and Device Integration of Colloidal Semiconductor Nanocrystals for Optoelectronic Applications
발표내용	III-V compound semiconductors referred to as pnictides, have a relatively small carrier effective mass, direct bandgap, and small exciton binding energy, which are attractive properties for state-of-the-art electronic and optoelectronic applications. The quantum-confined, nano-sized crystals based on these pnictides can possess additional benefits, including improved light absorbing/emitting properties, and optical bandgap tunability ranging from visible light to near/shortwave infrared. Given these advantages, the colloidal III-V quantum dots (QDs) can be integrated as a thin solid form into various optoelectronic devices such as LEDs, photovoltaics, and photodetectors. For high performance of QD-based optoelectronics, it is important to obtain highly monodisperse QDs, and simultaneously manipulate the surface defects that can enhance the optical and electrical properties in QD solids. In this presentation, we propose the synthesis design and surface engineering of colloidal III-V quantum dots to improve optoelectronic properties. First, we will explore the effect of metal halide-based additives on the surface of InP core materials for lighting applications. The metal halide complexes can clean up the InP nanocrystal surfaces by removing unavoidable oxides, and consequently, make these nanocrystals luminescent even without passivating shell structures. Another study about the effect of metal halide-based additives on InAs nanocrystals will be presented. During the InAs QD synthesis, the metal ions from the additives are chemically passivating the surface of InAs QDs, allowing to induce size-focusing as well as to remove surface defects. These metal ions can also modulate the electrical properties of InAs film in infrared detectors. Finally, we demonstrate that III-V QD films are promising candidate materials for both visible-light emitting devices and infrared detecting devices.