Nano-sized metals and semiconductors exhibit different properties from those bulk and supposed to be applied to various fields of technology. Light is a powerful tool for synthesizing nanoparticles (NPs). In addition, spectroscopy is an effective means in order to study the formation process of NPs and their optical properties. I conducted a study on the formation processes and the optical functions of various NPs from the point of view of photochemistry. Geometric structure has a strong bearing on the properties of semiconductor NPs. Synthesizing NPs composed of two or more chemical species significantly expands available NP geometric structures and functionality. Heterostructured NPs (HNPs) are promising materials in photoelectric conversion systems, sensors, and catalysts. This is because of the combined effect of independent functional units, and/or efficient carrier transfer between phases. Understanding the relationship between geometry (shape, volume, and heterointerface area) and carrier dynamics in HNPs is important for controlling photo-generated carriers in HNPs for practical use. Synthesizing HNPs with precisely controlled sizes and shapes remains a significant challenge to achieving this. I synthesized a series of HNPs (heterotetrapod composed by the chalcopyrite CuInS$_2$ (ch-CuInS$_2$) core and CdS arms, phase-segregated CdS/CdTe heterostructured nanopencils, with controlled anisotropic structure and CdS/CdTe volume, etc., using the wet chemical synthesis method (Figure 1). We also investigated how geometry influences photo-induced charge separation in HNCs using femtosecond (fs)-laser flash photolysis.

Figure 1. TEM images of (a) CdS/CdTe heteropencil and (b) CuInS$_2$/CdS

References

CBC SEMINAR ANNOUNCEMENT

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Photochemical Synthesis and Optical Properties of Nanoparticles

Nanotechnology