Doped semiconductor nanocrystals are an emerging class of materials hosting localized surface plasmon resonance (LSPR). Their wide spectral range (from visible to the entire IR regions) and post-synthetic tunability through doping promise new plasmon-assisted active optical materials and devices. Recent studies discovered different semiconductor species that perform efficient LSPR. However, the nanocrystals’ structural impact on their LSPR remain poorly explored, which is the current focus of our research. In this presentation, we will discuss how the structural factors can collaborate to exhibit novel LSPR properties that are unseen from metal hosts and how to utilize such properties in energy and biomedical issues.