

# SEMICONDUCTOR TYPE II NANO-HETEROSTRUCTURES THROUGH CATION EXCHANGE REACTIONS

**Jessica Rodríguez-Fernández**<sup>a,b</sup>

<sup>a</sup>*Department of Physics and Center for Nanoscience (CeNS), Ludwig-Maximilians-Universität München, Amalienstr. 54, 80799 Munich, Germany*

<sup>b</sup>*Nanosystems Initiative Munich (NIM), Schellingstr. 4, 80799 Munich, Germany*

Colloidal nano-heterostructures composed of dissimilar materials have gained increasing attention in recent years,[1-3] very especially those consisting of anisotropic semiconductor nanocrystals interfaced with noble metals.[4] All-semiconductor anisotropic nano-heterostructures are attractive as well, most notably those with a type II band alignment due to the possibility of charge separation upon photoexcitation. On the other hand, cation exchange is one of the most versatile approaches to produce a wide range of nanostructures that are hardly achievable by direct syntheses approaches. We have recently shown that cation exchange can serve as a tool to synthesize different types of nanoparticles[5] and nanoparticle clusters[6] based on copper chalcogenides.

In this talk it will be shown how cation exchange can also be employed to obtain heterostructured nanorods with a type II band alignment.[7] These nano-heterostructures consist of two distinctive crystalline semiconductor moieties of a cadmium and a copper chalcogenide. The optical properties and electronic interaction of both sub-units will be discussed. It will be highlighted the need to conveniently engineer the different sub-units in order to enable their application in photoenergy conversion. It will also be shown how challenges associated with the tendency of the copper chalcogenide sub-unit toward vacancy-doping may be overcome through the formation of electronically-coupled hybrid structures.[8]

## References

- [1] R. Costi *et al.*, *Angew. Chem. Int. Ed.* 49, 4878 (2010).
- [2] A. Vaneski *et al.*, *Adv. Funct. Mater.* 21, 1547 (2011).
- [3] E. Shaviv *et al.*, *ACS Nano* 5, 4712 (2011).
- [4] A. Vaneski *et al.*, *Adv. Funct. Mater.* 21, 1547 (2011).
- [5] I. Kriegel *et al.*, *ACS Nano* 7, 4367 (2013).
- [6] M.A.H. Muhammed *et al.*, *J. Am. Chem. Soc.* 137, 11666 (2015).
- [7] I. Kriegel *et al.*, *J. Mater. Chem. C* 2, 3189 (2014).
- [8] S. Neyshtadt *et al.*, *Nanoscale* 7, 6675 (2015).