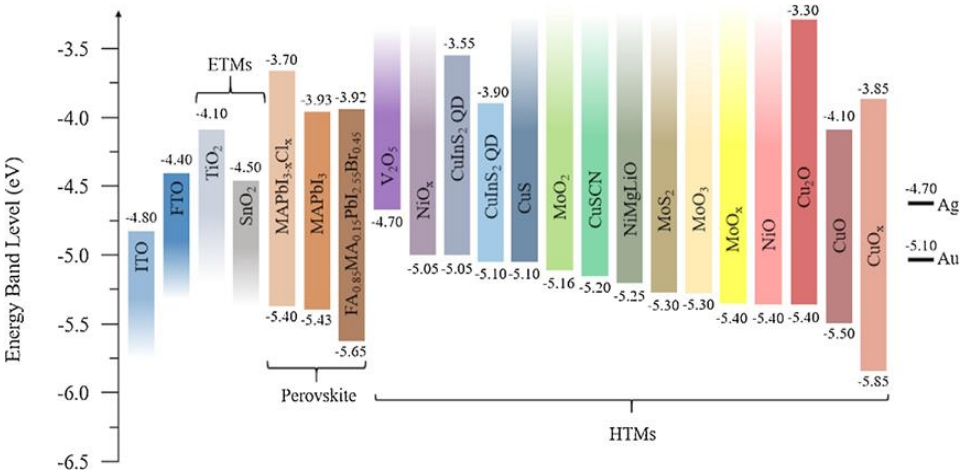
JUSTUS-LIEBIG-
UNIVERSITÄT
GIESSEN

MASTER THESIS
in Chemistry or Advanced Materials

Novel Composite Hole-Transporting Materials based on Inorganic Semiconducting Nanoparticles and Seminconducting Polymers for Emerging Photovoltaics

The development of hole transporting materials (HTMs), able to efficiently extract photo-generated charges from light-harvesting species such as metal halide perovskites, is subject of intense research in the last 5 years, in conjunction with the steady growth of the state-of-the-art power conversion efficiencies of perovskite solar cells (PSCs). Inorganic p-type semiconductor materials are promising HTMs to replace the organic HTMs currently used in PSCs, owing to their intrinsically better long-term stability, high hole mobility and low cost fabrication.[1] Difficulties related to the direct processing of inorganic p-type semiconductors on top of perovskite layers can be overcome by employing colloidal nanoparticles. The preparation of composites of such nanoparticels with p-type semiconducting polymers is also a smart strategy to obtain thin films of desired thickness, through the use of spin-coating or similar techniques.

In this Master Project, the Student will synthesize and characterize via sol-gel chemistry inorganic nanoparticles among the ones indicated in this Figure and prepare composites of these nanoparticles with polymers such as poly(3-hexylthiophene) (P3HT) and poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS).



The strict collaboration with the group of Prof. B. Smarsly for the synthesis of the inorganic nanoparticles will be essential. In addition, the collaboration with the group of Prof. D. Schlettwein in the Institut für Angewandte Physik will allow the testing of the HTMs in PSCs and the realization of a detailed photophysical characterization of the HTMs and of the perovskite/HTM interfaces.

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References

1. Z. Yu, L. Sun *Adv. Mater.* **2015**, *5*, 1500213