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Master thesis proposal

Hosting laboratory:

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<p><i>Novel perovskite oxide thin films for photovoltaics</i></p>
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A. Bibliographic topic:

Use of oxides as active layer in solar cells.

B. Experimental topic:

Inorganic thin film photovoltaics (PV) are mainly based on CdTe, amorphous Si or CIGS [1]. Another possible way is the use of metal oxides, that are generally stable, non-toxic, abundant and can be synthesized by various methods.

The ideal bandgap width of an active PV layer for the solar spectrum is around 1.3 eV. However conductive oxides with such a low bandgap width are scarce [2]. One of the most studied oxides as active PV layer is cuprous oxide Cu₂O. Its bandgap width of 2 eV is not ideal for to the solar spectrum, and conversion efficiencies do not exceed 4 % [3].

Novel perovskite oxides that have promising properties for PV have been identified. The objective of this work is to confirm with experiments their potential for PV.

The project will consist first in the synthesis and characterization of such novel perovskite oxide thin films. Then, *pn* junctions based only on oxide materials will be obtained and characterized. Finally all-oxide solar cells will be obtained to assess their potential for PV.

Tools: thin film deposition (sputtering) ; structural, surface, optical and electrical characterizations (XRD, AFM, UV-visible spectroscopy, ellipsometry, Hall effect, IV curves under illumination ...) ; device modeling.

[1] Fundamentals of Materials for Energy and Environmental Sustainability, Cambridge University Press (2012).

[2] I. E. Castelli et al., Energy & Environmental Science **5**, 5814 (2012).

[3] Z. Zang et al., Optics Express **21**, 11448 (2013).

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