Title: **NiO and Li-NiO as hole transport layers in the CuBi2O4 photocathodes.**

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Our current economy is heavily based on the burning of fossil fuels, which aggravates the climate change and has the issue that fossil fuels are limited. The only real option for the future is an economy based in renewable energy sources, such as solar energy. The biggest challenge now is to optimise this energy sources to make them market competitive. One of the main issues with solar energy is its variability, meaning that an efficient way to store solar energy must be found, and the current trend is towards hydrogen production through water splitting.

It has been found that copper bismuthate ($CuBi_2O_4$), a p-type semiconductor, may be an optimal for water reduction, since has a band gap of 1.6-1.8 eV and a photocurrent onset potential near 1V vs RHE. The only problem is that has a low efficiency. To solve this issue, NiO has been introduced as hole transporting layer. Also, it is known that NiO has a low conductivity, which reduces its efficiency as HTL, and to solve that a lithium doping has been introduced to the NiO.

In this thesis, it has been found that NiO, $CuBi_2O_4$, and lithium doped NiO thin films can be synthesised successfully with the sol gel method, using FTO as support. Then testing these films in photoelectrochemical tests has been found that the introduction of NiO as hole transport layer ($CuBi_2O_4$ /NiO/FTO) significantly increases the photogenerated current of the system over the $CuBi_2O_4$ /FTO system. It was also observed that using lithium doped films as hole transporting layer also increases the photogenerated current in comparison to the non-doped films.

These two discoveries are very interesting because this may be a way to hydrogen production using cheap and easy to synthesise materials which could be market competitive, which is the renewable energy sources research final objective. Having

said this, this thesis is just a first approach to the matter, and many things need still to be improved.