Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.


# Enhanced thermoelectric performance of PEDOT with different counter ions optimized by chemical reduction

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1. Removal of the gold layer.

The gold has been removed after the polymer growth by immersing the substrate with the polymer film into Royal water. A video showing the process has been added to this supplementaryinformation (https://www.dropbox.com/s/r2v9wot6mcxzjb5/video%20del%20oro.mp4).

Figure S1 shows the polymer film on the glass substrate before and after the gold has been removed.

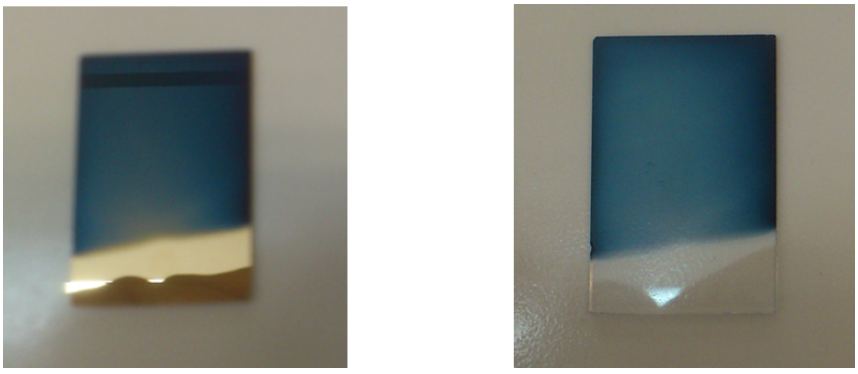

Figure S1. PEDOT:$ClO_4$ with the gold layer (left) and after removing the gold layer (right).

An additional proof that the gold has been removed can be found in the graphs shown below. We measured the electrical conductivity and the Seebeck effect in one of the samples previous the gold removal using the van der Pauw method with four contacts on top of the polymer. After crossing the polymer film, the current goes through the gold film and as a result, the electrical conductivity is very high, as can be observed in Figure S2. Both the electrical conductivity and Seebeck coefficient remains constant as a function of the reduction time since the current goes mainly through the back contact produced by the gold. Figure S3 shows the same measurements after removing the gold with Royal water. Clearly, the gold has been completely removed, since the electrical conductivity decreases several orders of magnitude.

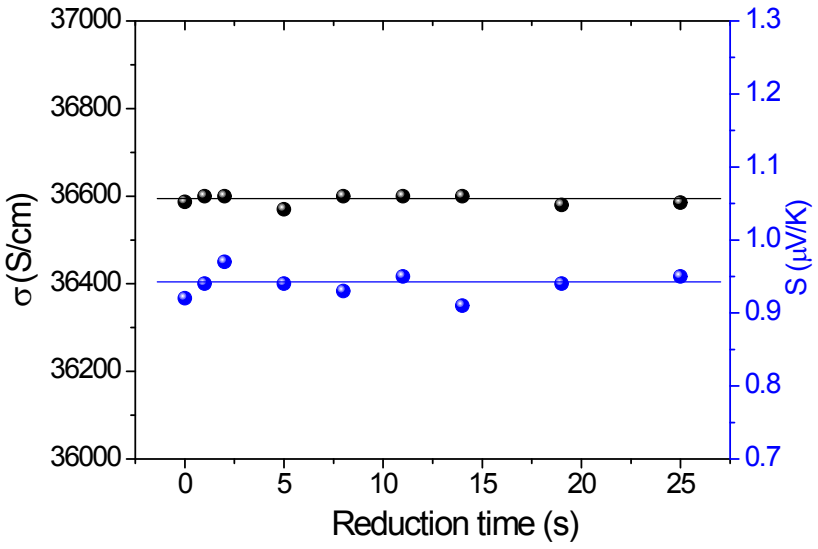


**Figure S2.** Electrical conductivity and Seebeck coefficient in a polymer film with the gold below the polymer film.

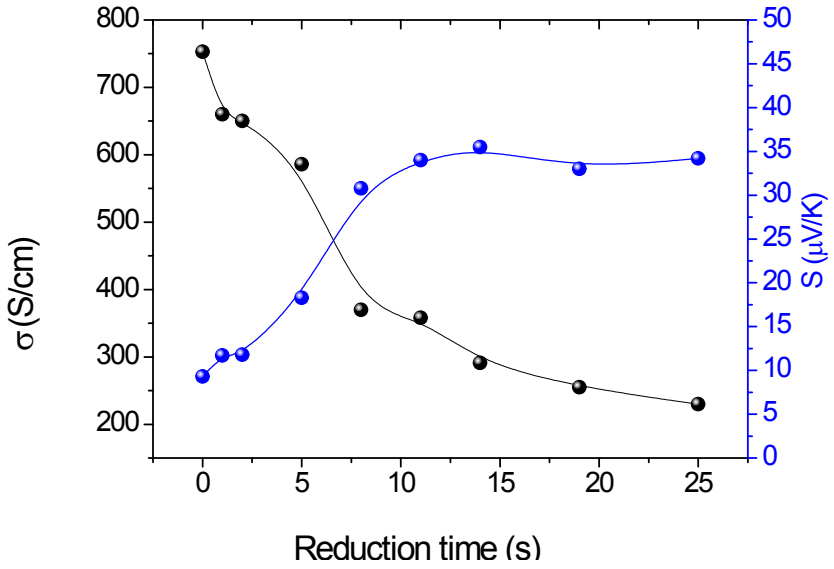


**Figure S3**. Electrical conductivity and Seebeck coefficient of the same polymer sample after the gold has been removed.

In addition, PEDOT:$ClO_4$ was electrodeposited on a glass substrate with indium tin oxide (ITO). Them the film was subjected to the same acid treatment than samples synthetized with gold and a spectrum UV-Vis-NIR was performed before and after treatment, in order to ensure that the acid treatment does not alter the electronic properties. Figure S4 shows no differences between before and after of acid treatment; in conclusion the films properties are not affected by the acid treatment.

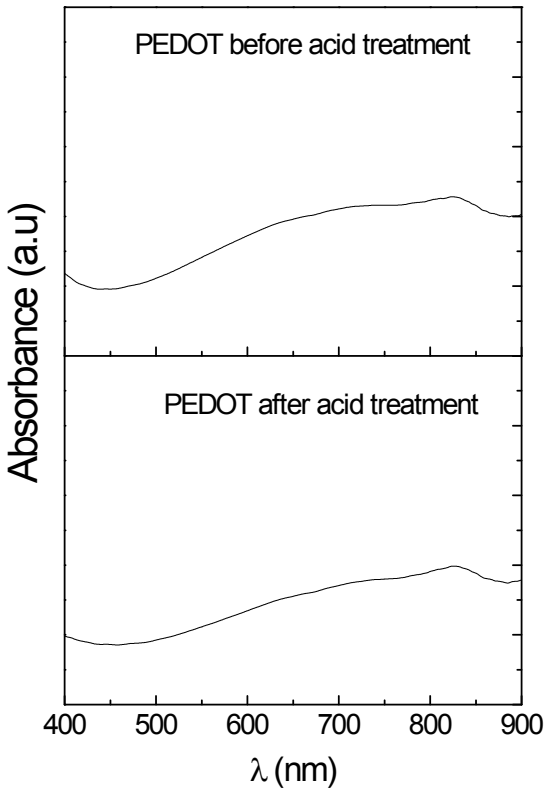


**Figure S4**. UV-Vis-NIRs spectra of PEDOT:$ClO_4$ before and after acid treatment.