Dye sensitized solar cells – how far are we from a commercial product?

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Dye-sensitized solar cells (DSSCs) were first proposed by Michael Grätzel in 1991.[1] Since then the scientific knowledge and performance of these devices observed a tremendous evolution; still, these devices are mostly not commercial. The number one reason is the stability of DSCs, which has never been properly addressed by the research community. Other reasons are related to target market for these devices that was never clearly defined, besides other technological aspects related to their fabrication. Indeed, the research community has been so far deeply fascinated in developing and testing new materials targeting more efficient devices, neglecting other important objectives towards the development of DSCs.

Recently a new glass sealing process for DSCs assisted by laser was described.[2, 3] This was probably the greatest advancement so far towards the development of stable DSC devices, since their invention in 1991. Glass sealing is now performed at ca. 250 °C but new developments should allow soon laser assisted glass sealing of glass-glass substrates at ca. 100 °C. This will be especially critical for solid-state devices and it will allow obtaining leak free cells produced at very low costs. Moreover, if the sealing frits, photoelectrode and counter-electrode materials are applied to the substrate using an ink-jet technique and the glass sealing is obtained using a robot guided laser beam, the cells can easily display tailor made draws – Figure 1. Besides, DSCs can be sealed to a front glass window covered by a back glass window to produce a double-glazing window containing thin DSC cells. This DSC double-glazing window will exhibit the following properties: a) façade barrier; b) architectural and aesthetic and; c) electricity production – Figure 2. The recently proposed ETCO (embedded transparent conducting oxide) technology allows very electrical conductive substrates making possible aesthetic DSC sub-modules with very high effective to geometric areas.[4] Finally, it was recently demonstrated by simulation that optimized DSC devices with energy conversion efficiencies up to 15 % can be produced with the convectional technology if properly optimized.[5] Since, in average, DSCs produce more 40 % energy in real outdoor conditions than the c-Si photovoltaic cells counterpart, DSCs show already equivalent performances.[6]

There is a market for DSC technology! The efficiency shown by these devices is already good enough. Still need addressing the stability; promising steps were already given. It is now necessary more researchers addressing the stability of dyes, electrolytes and electrodes.

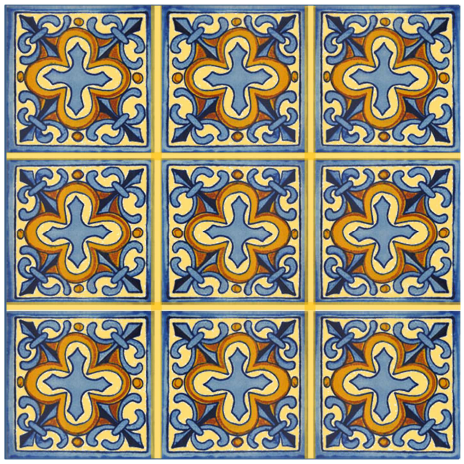

Figure 1 – Typical portuguese tiles to be replicated in DSC cells.

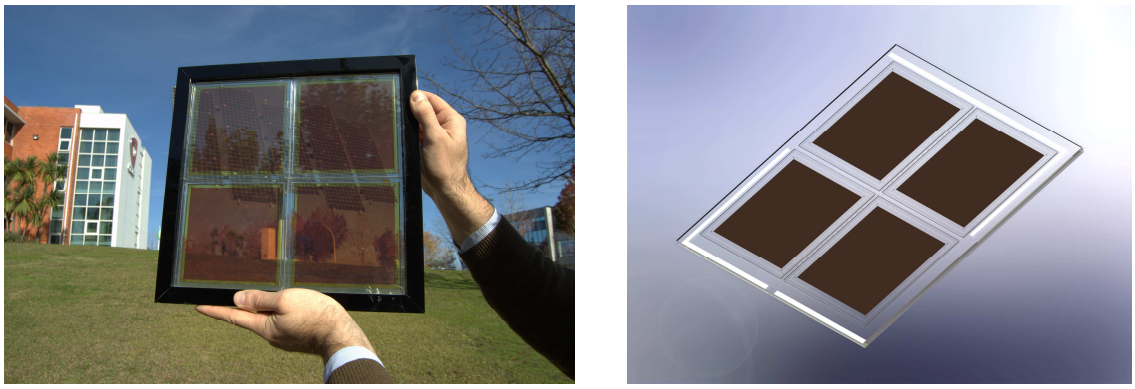

Figure 2 – DSC window prototype.

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