Comparative study of the anchorage and the catalytic properties of nanoporous TiO2 films modified with ruthenium (II) and rhenium (I) carbonyl complexes

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In this article we study the anchoring of cis-[Ru(bpyC4pyr)(CO)2(CH3CN)2]2+, cis-[Ru(bpy)2(CO)2]2+ and cis-[Ru(bpyac)(CO)2Cl2], onto nanoporous TiO2 employing electropolymerization, electrostatic interaction and chemical bonding. Also, the [Re(bpyac)(CO)3Cl] rhenium(I) complex for chemical anchorage was analyzed. The characterization of TiO2/Ru(II) and TiO2/Re(I) nanocomposite films was performed by field emission scanning electron microscopy (FESEM), electron dispersive X-ray spectroscopy (EDS) and Raman spectroscopy. In addition, for the more stable nanocomposites obtained, the catalytic properties (solar energy conversion and CO2 reduction) were evaluated. The efficiency improvement in redox process derived from the (photo)electrochemical evidence indicates that modified nanoporous TiO2 structures enhance the rate of charge transfer reactions.

Catalytic properties

EDS mapping

Nanoporous TiO2 films

Rhenium complex

Ruthenium complex

Anchorages (foundations)

Charge transfer

Chemical analysis

Chemical bonds

Chlorine compounds

Electropolymerization

Energy conversion

Field emission microscopes

Image enhancement

Iodine

Nanocomposite films

Nanocomposites

Redox reactions

Rhenium

Ruthenium

Scanning electron microscopy

Solar energy

Titanium dioxide

X ray spectroscopy

Catalytic properties

Charge-transfer reactions

Comparative studies

Efficiency improvement

Field emission scanning electron microscopy

Nanoporous tio2

Rhenium complexes

Ruthenium complexes

Titanium compounds