UNIVERSIDADE ESTADUAL DE CAMPINAS
INSTITUTO DE QUÍMICA

PROGRAMS AND BIBLIOGRAPHY

Subject	
Code	**Name**
QF854	Photoelectrochemistry in Semiconductor Materials: Principles and Applications

Vector
OF:S-5 T:002 P:000 L:000 O:000 D:000 HS:002 SL:002 C:002 AV:N EX:S FM:75%

Pre requisite	QF431 QF531

Summary

Properties of n-type and p-type semiconductors; charge transfer processes at the semiconductor/electrolyte interface; technological applications in photoelectrochemical devices for solar energy harvesting and conversion; solar cells; water contaminant removal; production of "solar fuels" through CO2 reduction or water electrolysis.

Program

Lectures 1 – 3

Properties of semiconductors and the energy band model: type-n and type-p semiconductors; forbidden band energy; light absorption in semiconductors; charge carriers.

Lectures 4 – 6

Semiconductor/electrolyte interface; electrical double-layer model; charge distribution at the interface and band "bending"; charge transfer processes in semiconductor electrodes.

Lectures 7 – 12

Technological applications of semiconductors in photoelectrochemical devices for solar energy harvesting and conversion: conversion of solar energy to electricity: solar cells; conversion of solar energy for water treatment; conversion of solar energy for the production of "solar fuels": obtaining H2 and O2 through water splitting electrolysis; CO2 reduction to generate higher value products.

Bibliography

Semiconductor photoelectrochemistry, Yu. Ya. Gurevich, Yu. V. Pleskov. P. N. Bartlett (ed.). NY 1986.

H. Gerischer, "The impact of semiconductors on the concepts of electrochemistry", *Electrochim. Acta* **35** (1990) 1677-1699.

Environmental Electrochemistry: Fundamentals and Applications in pollution abatement. Krishnan Rajeshwar, Jorge Ibanez. Academic Press (1997).

Electrochemistry of Nanomaterials, ed. By Gary Hodes. Wiley-VCH (2001).

Anders Hagfeldt, Gerrit Boschloo, Licheng Sun,Lars Kloo, Henrik Pettersson, "Dye-Sensitized Solar Cells", *Chem. Rev*. 110, (2010), 6595–6663.

Xiaobo Chen,Can Li, M. Gratzel,R. Kostecki, SS. Mao. "Nanomaterials for renewable energy production and storage", *Chem. Soc.Rev.* **41** (2012), 7909-7937.

Evaluation criteria
Evaluation criteria are defined by the Instructor on the bases of Section I – General Norms, Chapter V – Student Evaluation in the Subject, from the General Undergraduate Regiment. Attendance: 75 % (* Allowance for non-attendance will be considered according to Chapter VI, Section X, article 72 from the General Undergraduate Regiment).