Code: **QF854**

Name: **Fotoeletroquímica em Materiais Semicondutores: Princípios e Aplicações**

Name in English: **Photo Electrochemistry in Semiconductor Materials: Principles and Applications**

Name in Spanish: **Fotoelectroquímica en Materiales Semiconductores: Principios y Aplicaciones**

Subject type: **Weekly**

Approval Type: **Grade and Attendance**

Characteristic: **Regular**

Frequency: **75%**

Period Type / Offering Period: **Semester / All periods**

Requires Final Exam: **Yes**

Vectors

T	L	P	O	PE	OE	SL	WEEKS	CREDITS
2	**-**	**-**	**-**	**-**	**-**	**2**	**15**	**2**

Occurrence on curriculum:

Pre requirement: **QF531 + QF431**

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

Program:

Semiconductor properties and energy band model: n-type and p-type semiconductors; band gap energy and light absorption in semiconductors; charge carriers.

Semiconductor|electrolyte interface; electric double layer models; charge distribution at the interface and band bending; charge transfer processes in semiconductor electrodes.

Technological applications of semiconductors in photoelectrochemical devices for harnessing and converting solar energy: solar energy conversion to electricity: solar cells; solar energy conversion for water treatment: photocatalytic oxidation of contaminants in water; solar energy conversion for "solar fuels" production: obtaining H_2 and O_2 through water electrolysis ("water splitting"); CO_2 reduction to generate higher value-added products.

Seminars and exam for assessment of the discipline's performance.

Basic Bibliography

1) GUREVICH, Y. Y.; PLESKOV. Y. V. BARTLETT, P. N. **Photoelectrochemistry**, 1 Ed. New York: Consultants Bureau, 1980, 239 p.

2) RAJESHWAR, K.; IBANEZ, J. **Environmental Electrochemistry: Fundamentals and Applications in pollution abatement**. Academic Press, 1997.
3) GRÄTZEL, M. **"Photoelectrochemical cells**", *Nature* 414, 338–344 (2001). https://doi.org/10.1038/35104607

Supplementary Bibliography:

1) HAGFELDT, A.; BOSCHLOO, G.; SUN, L.; KLOO, L.; PETTERSSON, H. "**Dye-Sensitized Solar Cells**", Chem. Rev. 110, (2010), 6595–6663.
2) CHEN, X.; LI, C.; GRATZEL, M.; KOSTECKI, R.; MAO, S.S. "**Nanomaterials for renewable energy production and storage**", *Chem. Soc. Rev*. 41 (2012), 7909-7937. https://doi.org/10.1039/C2CS35230C
3) GERISCHER, H. "**The impact of semiconductors on the concepts of electrochemistry**", *Electrochimica Acta* 35 (1990) 1677-1699. https://doi.org/10.1016/0013-4686(90)87067-C
4) QU, X., ALVAREZ, P. J. J., LI, Q. "**Applications of nanotechnology in water and wastewater treatment**." Water Research 47 (2013), 3931-3946.
5) INGLIS, J. L.; MACLEAN, B. J.; PRYCE, M. T.; VOS, J. G. "**Electrocatalytic pathways towards sustainable fuel production from water and CO_2**", Coord. Chem. Reviews 256 (2012) 2571– 2600
6) ROY, N.; SUZUKI, N.; TERASHIMA, C.; FUJISHIMA, A. "**Recent Improvements in the Production of Solar Fuels: From CO_2 Reduction to Water Splitting and Artificial Photosynthesis**", Bulletin of the Chemical Society of Japan 92 (2019) 178-192. https://doi.org/10.1246/bcsj.20180250