

# ELECTROCHEMICAL SCIENCE AND ENGINEERING GRADUATE MINOR

<b>Minor Graduate Program Head</b>	Mort Webster
<b>Program Code</b>	ECSE
<b>Campus(es)</b>	University Park
<b>The Graduate Faculty</b>	View ( <a href="https://secure.gradsch.psu.edu/gpms/?searchType=fac&amp;prog=ECSE">https://secure.gradsch.psu.edu/gpms/?searchType=fac&amp;prog=ECSE</a> )

This graduate minor is highly relevant to numerous graduate degree programs associated with energy, materials, and environmental sciences offering a unique set of skills that will benefit graduate students to develop expertise in electrochemical systems that complements their primary focus in batteries, fuel cells, or structural design. The minor will also help expand the students' knowledge and capabilities in important topics relating to electrochemical and renewable energy fundamentals, devices and systems.

## Admission Requirements

Any graduate student enrolled at Penn State in a related field of study may be admitted to the Electrochemical Science and Engineering graduate minor.

## Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The doctoral minor will consist of no fewer than five 3-credit courses (15 credits) of integrated or articulated work in electrochemical science and engineering, related to but different from, that of the major, drawn from the two lists (500-level courses and 400-level courses) below, with a preponderance of courses at the 500 level. A minimum of 6 credits must be at the 500 level for the doctoral minor.

Code	Title	Credits
<b>500-level Courses</b>		
EME 541	Electrochemical Science and Engineering Fundamentals	3
CHEM 524	Electroanalytical Chemistry	3
ESC 501	Solar Cell Devices	3
CHE/MATSE 510	Surface Characterization of Materials	3
CHE 528	Colloidal Forces and Thermodynamics	3
MATSE 560/ MNPR 507	Hydrometallurgical Processing	3
MATSE 501	Thermodynamics of Materials	3
MATSE 503	Kinetics of Materials Processes	3
<b>400-level Courses</b>		
EGEE 420	Hydrogen and Fuel Cells	3
EGEE 437	Design of Solar Energy Conversion Systems	3
EGEE 441	Electrochemical Engineering Fundamentals	3

EME 407	Electrochemical Energy Storage	3
ESC 455	Electrochemical Methods Engineering and Corrosion Science	3
MATSE 421	Corrosion Engineering	3
ME 403	Polymer Electrolyte Fuel Cell Engines	3

The master's minor will consist of no fewer than two 3-credit courses (6 credits) of integrated or articulated work in electrochemical science and engineering, related to but different from, that of the major, drawn from the two lists above. A minimum of 3 credits must be at the 500 level for the master's minor.

A student enrolled in this graduate minor must receive a grade of B- or better in all minor courses.

A representative from the Graduate Faculty in the graduate minor (i.e., a "Minor Field Member") must be appointed to the dissertation committee of each student enrolled in the doctoral minor in Electrochemical Science and Engineering.

## Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

## Contact

<b>Campus</b>	University Park
<b>Graduate Program Head</b>	Mort D Webster
<b>Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)</b>	Serguei Lvov
<b>Program Contact</b>	Serguei Lvov 207 Hosler Building University Park PA 16802 sxl29@psu.edu (814) 863-8377
<b>Program Website</b>	View ( <a href="http://www.eme.psu.edu/emegrad/">http://www.eme.psu.edu/emegrad/</a> )