



**UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY
COURSE SYLLABUS
WINTER 2022**

1. Course: Chemistry 571, Physical Chemistry of Interfaces

LEC	DAYS	TIME	ROOM	INSTRUCTOR	OFFICE	EMAIL	OFFICE HOURS
L01	TuTh	12:30-13:45	SA109 or Online	Dr. Yujun Shi	SB 301	shiy@ucalgary.ca	TBA

Course website: d2l.ucalgary.ca [CHEM 571 L01-(Winter2022)-Physical Chemistry of Interfaces]

Departmental Office: Room SB605 | Tel: 403-220-5385 | e-mail: chem.info@ucalgary.ca

- 2. Course Description:** The chemical and electrical nature, as well as basic thermodynamics, of interfaces. Surface films and aqueous interfaces. Interfaces involving solids such as metals and semiconductors. Absorption phenomena and surface catalysis. Survey of experimental approaches for interfacial studies.
- 3. Recommended Textbook(s):** *Physics and Chemistry of Interfaces, 3rd Edition* Wiley-VCH by Hans-Jürgen Butt, Karlheinz Graf, and Michael Kappl

Other REQUIRED course materials (available from the bookstore):

- A non-programmable scientific calculator (Casio FX 260 or equivalent)

4. Course contents:

Note: Not all sub-sections of each textbook chapter will be covered. More details will be provided during the lectures.

Chapter 1. Introduction

- 1.1 What are interfaces?
- 1.2 The importance of surface or interface properties
- 1.3 The Importance and applications of interfacial chemistry

Chapter 2. Surface Tension, Surface Energy, and Thermodynamics of Interfaces

- 2.1 Surface tension – an introduction
- 2.2 Surface tension as a force
- 2.3 Surface tension as surface energy
- 2.4 A molecular-level picture of surface tension
- 2.5 Intermolecular forces
- 2.6 van der Waals forces between macroscopic particles
- 2.7 Thermodynamics of interfaces

Chapter 3. Liquid Surfaces, Contact Angle, and Wetting

- 3.1 Liquid surfaces – An introduction
- 3.2 The Young-Laplace Equation – Curvature of liquid surface
- 3.3 Contact angles and wetting
- 3.4 Measuring the surface tension and contact angles
- 3.5 The vapor pressure of a liquid surface – the Kelvin Equation

Chapter 4. Solid Surfaces Part I – Crystalline Surface

- 4.1 Solid surfaces – an introduction
- 4.2 Crystalline surfaces (surface crystallography)
- 4.3 (Bulk) crystal structures
- 4.4 Description of crystalline surfaces
- 4.5 Surface relaxation and reconstruction
- 4.6 Solid surface defects

Chapter 5. Solid Surfaces Part II – Adsorption

- 5.1 Introduction
- 5.2 Physisorption and chemisorption
- 5.3 Adsorption kinetics
- 5.4 Adsorption isotherms – an overview
- 5.5 Langmuir adsorption isotherm
- 5.6 Freundlich adsorption isotherm
- 5.7 BET isotherm
- 5.8 Measuring adsorption on solid surfaces

**Chapter 6. Surface Analysis Techniques and their Applications
(Including student presentations)**

- 6.1 An overview of surface analysis techniques
- 6.2 X-ray photoelectron spectroscopy
- 6.3 Auger electron spectroscopy