#011

Title: Basics in modern high-pressure techniques

Abstract:
The main goal of the internship is familiarizing the participants with the Diamond Anvil Cell (DAC) and the fundamental procedures of the high pressure technique, such as preparation of the gasket, hole drilling on the gasket, and measurement of the pressure.

Contact person(s): Haijing Meng

Time requirements: 2 days, 10-11 hours

Remarks: Please contact the indicated person at least 2 weeks prior to the expected internship date.
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#021

Title: Determination of thickness and optical parameters of thin solid films using spectral ellipsometry

Abstract:
The goal of the training involves determination of (1) thickness of self-assembled layers of long-chain thiols on the gold support and (2) thickness and optical parameters of thin films of polymers with spectral ellipsometry. To achieve the first goal, gilded glass slides will be coated by thin self-assembled layer of thiol by adsorption from solution. To achieve the second goal, a film of polyacrylic acid will be deposited on a solid support by drop-coating or spin-coating. The prepared polymer samples will be examined by spectral ellipsometry. The ellipsometric spectra recorded, in combination with mathematical modeling, will be used to determine the thickness of self-assembled monolayers as well as thickness and optical properties of the polymer films.

Contact person(s): Krzysztof Noworyta and Paweł Borowicz

Time requirements: one day, 6-8 hours (plus 1-2 hours a day before)

Remarks: Please contact any of the persons indicated above at least 4 weeks before the expected training day.

#022

Title: Property studies of monomolecular films at the air-water interface

Abstract:
The main goal of the training is (1) to acquaint the students with a method of monomolecular film preparation at the air-water interface (so called Langmuir films) and (2) to study morphology and electrical properties of this film. The students will simultaneously record the surface pressure and surface potential compression-expansion isotherms of selected long-chain aliphatic acids (fatty acids). Moreover, they will study morphology of these films with the use of Brewster Angle microscopy (BAM). From the isotherms recorded the students will subsequently calculate thermodynamic parameters of the studied films.

Contact person(s): Krzysztof Noworyta and Karolina Gawecka

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the persons indicated above at least 4 weeks before the expected training.

#023

Title: Application of cyclic voltammetry for determination of stability constants of complex formation

Abstract:
The aim of the exercise is to study complex forming tendency of selected ligands and metals in aqueous solutions. During the exercise, stability constants and coordination number of pyrazole complex of cadmium (II) will be determined. In view of reversible redox process of cadmium (II) at the hanging mercury drop electrode, the cyclic voltammetric peak of Cd (II) will be used to investigate complex formation with help of Lingane's method.

Contact person: Valerii Malyshev

Time requirements: Max. 6-7 hours

Remarks: Please contact the indicated person at least 4 weeks prior to the expected internship date.

#041

Title: Preparation and charactersation of thin graphene films

Abstract:
The goal of this laboratory is to use electrochemical methods to obtain thin graphene films on the electrode surfaces and to study their physicochemical properties. A thin graphene oxide film will be electrophoretically deposited on an ITO electrode and electrochemically reduced. The properties of the obtained material will be studied using UV-Vis and electrochemical impedance spectroscopies (EIS).

Contact person(s): Joanna Niedziółka-Jönsson, Adam Leśniewski

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the indicated persons at least 2 weeks prior to the expected internship date.

#061

Title: NMR investigations on molecular structure and dynamics in liquids

Abstract:
The goal of this workshop is to (1) get familiar with the typical applications of NMR technique used for investigations on molecular structure in liquids (i.e. analysis of 1- and 2-dimensional NMR spectra of various types), and (2) get falimiar with some less typical applications of NMR spectroscopy used for investigations of slow and very fast molecular dynamics. In point (2) nuclear spin relaxation techniques are exploited along with numerical lineshape analysis.

Contact person(s): Piotr Bernatowicz

Time requirements: 1 day, 6-8 hours

Remarks: Please contact the indicated person at least 4 weeks prior to the expected workshop date.

#062

Title: A Practical Introduction to Solid State Nuclear Magnetic Resonance

Abstract:

The nuclear magnetic resonance (NMR) technique is currently widely employed in science, medicine and industry. In particular, solid state NMR (SSNMR) spectroscopy is a powerful analytical technique which is commonly employed for the characterization of different kind of solids and semi-solids, such as various nanomaterials, heterogeneous catalysts and pharmaceuticals.

The main aim of this one-day training is to give a general overview of the potential of the SSNMR technique. It is expected that after the internship, the interns will be able to preliminarily evaluate what types of problems can be solved by SSNMR, and what types of materials can be investigated via SSNMR.

In the first part of the training, a short introduction to solid state NMR will be given. The current state-of-the-art research in the area of SSNMR will be briefly discussed, particularly in the field of materials chemistry and catalysis. The second part of the exercise is aimed at familiarizing the participants with the important practical aspects of SSNMR. In particular, the participants will learn how to prepare samples for typical NMR experiments. Afterwards, how to setup and record SSNMR spectra for various nuclei of an exemplary sample will be presented. During this part of the internship, the student will also learn basic aspects of data processing.

Contact person(s): Tomasz Ratajczyk

Time requirements: 10 hours

Remarks: Please contact the indicated person at least 2 weeks prior to the expected workshop date.

#101

Title: Single crystal X-ray diffraction

Abstract:

The goal of this laboratory internship is to get familiar with the XRD technique and structure analysis a) what it can tell us (and what can not) b) how to interpret the structure c) the use of CSD - Cambridge Structural Database.

The whole procedure will be performed [for sucrose or other compound]: starting from single crystal preparation , data collection, structure solution and refinement up to the structure visualization and interpretation.

Contact person(s): Roman Luboradzki

Time requirements: 1 day, 6-8 hours

Remarks: Please contact the indicated person at least 1 week prior to the expected date.

#102

Title:
Fluorescence correlation spectroscopy measurements in complex systems

Abstract:
The goal:

1. To learn how to prepare samples and to perform measurements by means of fluorescence correlation spectroscopy;
2. Measurements of diffusion coefficients of chosen fluorescent probes in the model complex fluids (polyethylene glycol and/or dextran solutions).

Contact person(s):
Tomasz Kalwarczyk, Krzysztof Sozański

Time requirements:
Two days , 12-16 hours

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#103

Title: Determination of the ligand-macromolecule association constant by Flow Injection Analysis

Abstract:
The goal of this laboratory internship is to (1) get familiar with the new method allows to determine interaction between different types of the ligand (for example drugs) with the bovine serum albumin (2) to get familiar with the two spectroscopic types of detection (UV-vis and fluorescence).

Contact person(s): Aldona Majcher, Anna Lewandrowska

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#104

Title: Rheological characterization of chemical substances

Abstract:
The aim of the internship is to familiarize PhD students with the rheological measurements allowing to characterize flow properties of a range of substances, used both in a chemical laboratory (eg. aqueous solutions of polymers) and in everyday life. Classification of the samples will be carried out according to their rheological properties: Newtonian, non-Newtonian, pseudoplastic, dilatant, and thixotropic fluids. During the internship, PhD students will familiarize with measurements performed using a "falling ball" instrument and a rotational rheometer.

Contact person(s): Agnieszka Wiśniewska

Time requirements: 2 days, 16 hours

Remarks: Please contact the indicated person at least 4 weeks prior to the expected internship date.

#111

Title: Droplet formation in T-junctions using visual feedback

Abstract:
The goal of this laboratory is to get familiar with the mechanism of droplet formation in microfluidic T-junctions with the use of LabVIEW program. Usually droplets are formed in T-junctions using continuous flows of two phases or using external electromagnetic valves. In the second case times of opening and closing valves determine length of droplets. However in more complex systems, where the hydrodynamic resistance is changing during the experiment, these times are not good parameters to control the lengths of forming droplets. Thus it's better to use visual feedback to control lenghts of forming droplets. LabVIEW is an ideal environment for fully automatization of microfluidic experiments.

Contact person: Filip Dutka

Time requirements: 2 days, 12-16 hours

Remarks: Please contact the indicated person at least 2 weeks prior to the expected internship date.

#112

Title: Basic microfluidic techniques

Abstract:
The goal of this laboratory internship is to (1) get familiar with the techniques used for fabrication of microfluidic chips, and (2) methods of generation single and double phase liquids flows what is more (3) detection methods perform in microfluidic chips.

Contact person(s): Michał Horka, Artur Ruszczak

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#113

Title: Transformation of E. coli with plasmid placEGFP coding GFP fluorescent protein.

Abstract:
The main goals of the course are: (1) familiarizing participants with traditional methods of bacteria culturing and (2) fundamental molecular techniques used in microbiology such as preparation of competent cells, isolation of plasmid DNA, and transformation of plasmid DNA. Moreover, the course provides an opportunity to work with GFP fluorescent protein commonly used in molecular biology.
Contact person(s): mgr Artur Ruszczak, dr Judyta Węgrzyn
Time requirements:
Day 1: Methods used for culturing of microorganisms, isolation of plasmid DNA (5h)
Day 2: Obtaining competent cells (5h)
Day 3: Transformation of bacteria (5h)
Day 4: Reading results (observing bacteria using confocal microscope) (2h)
The total number of hours: ~17h

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#121

Title:
Pomiar wielkości cząstek koloidalnych metodą dynamicznego rozpraszania światła (DLS) oraz ich potencjału Zeta.

Abstract :
Celem ćwiczenia jest (1) poznanie metody pomiaru rozmiaru cząstek koloidalnych z wykorzystaniem techniki dynamicznego rozpraszania światła. Student w czasie ćwiczeń może wykorzystać swój własny roztwór koloidalny albo użyć roztworu dostępnego w zespole 12. Kolejnym celem ćwiczenia jest (2) wyznaczenie potencjału zeta badanych cząstek koloidalnych.

Contact person(s): Michalina Iwan, Ewelina Kalwarczyk

Time requirements: 1 day; 4-6 hours

Remarks: Please contact any of the indicated persons at least 2 weeks prior to the expected internship date.

#131

Title: Phase diagram of a hard spheres fluid

Abstract:
The goal of this laboratory internship is to (1) get familiar with the Monte Carlo simulations of simple fluids (2) calculate the phase diagram for the hard spheres fluid. The phase diagram will be obtained from the radial correlation function calculated for different densities.

Contact person(s): Paweł Rogowski, Jakub Pękalski

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#141

Title: Electrode reactions under hydrodynamic conditions.

Abstract:
The aim of the practical is (1) to learn how to do voltammetric measurements with a rotating disk electrode (RDE) and a rotating ring disk electrode (RRDE), and (2) to determine selected parameters of electrode reactions on the basis of the recorded voltammograms.
The electrode reactions of interest will be oxidation of ferrocyanide at RDE and reduction of oxygen at RRDE. Measurements will be performed with a potentiostat in a three-electrode cells. From the recorded voltammograms, students will determine number of electrons transferred during the reactions, diffusion coefficients of electroactive species, and the reaction yield.

Contact person(s): Martin Jönsson-Niedziółka, Magdalena Kundys

Time requirements: 2 days, 12 hours

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#142

Title: A practical introduction to scanning electron microscopy

Abstract:
The course will cover the basic modes of operation of SEM, sample preparation, x-ray spectroscopy and a description of the capabilities of our in-house microscope and other extended features. The course includes 4-5 hours of lectures and 4 hours of practical hands-on SEM imaging in small groups after which the students will be allowed to book and use the instrument on their own.

Contact person: Martin Jönsson-Niedziółka, tel. 3306.

Time requirements: as above

#151

Title: Physisorption (ASAP 2020, Micromeritics) for determination of surface area, pore volume and pore size distribution

Abstract:
The goal of this laboratory internship is to:

1. get familiar with gas sorption techniques, applied to a wide variety of meso- and macropore materials (activated carbons and carbon black, pharmaceuticals, ceramics, nanotubes, catalysts etc.);

2. determination of a single- and multipoint BET (Brunauer, Emmett, and Teller) surface area at the temperature of liquid nitrogen;

3. determination of a pore volume and a pore area distributions in the mesopore and macropore ranges by the BJH (Barrett, Joyner, and Halenda) method.

Contact person: Dr Magdalena Bonarowska

Time requirements: 1-2 days, 8-10 hours

Remarks:

1. Please contact the indicated person at least 3 weeks prior to the expected internship.
2. To eliminate the possibility of contamination of the instrument, all materials before an experiment should be heated in temperature at least 200^{o}C.

#152

Title: Chemisorption (ASAP 2020C, Micromeritics) for determination of metallic dispersion and active surface area

Abstract:
The goal of this laboratory internship is to:

1. get familiar with the static volumetric technique to determine the percent metal dispersion, active metal surface area and size of active particles;

2. determination of metal dispersion and active surface area from adsorption isotherms (using H_2 or CO) for a system "metal-on-support".

Contact person: Dr Magdalena Bonarowska

Time requirements: 1-2 days, 8-10 hours

Remarks:

1. Please contact the indicated person at least 3 weeks prior to the expected internship
2. To eliminate the possibility of contamination of the instrument, all materials before an experiment should be heated in temperature at least 200^{o}C

#153

Title: The application of an electron capture detector (ECD) to analyzing the progress of catalytic purification of water from chloroorganic compounds

Abstract:
The main goal of the laboratory internship is to learn the method of operation of a gas chromatograph equipped with an electron capture detector (ECD) as a very sensitive tool for the analysis of chloroorganic compounds in water.

The exercise will include:

- preparation of the catalyst,
- catalytic reaction in liquid phase,
- monitoring of reaction progress by gas chromatograph equipped with the ECD detector

Contact person(s): Anna Śrębowata (☎3320), Izabela I. Kamińska (☎3360)

Time requirements: 8 hours in 2 days

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#161

Title: Prospective applications of Powder X-Ray Diffraction (PXRD) in (non)routine chemical and physical research.

Abstract: The Training is based on a complete characterisation procedure of a policrystalline material:

a) sample preparation,
b) measurement setup and data acquisition,
c) analysis and interpretation of results including crystal structure determination and its imperfections.

The main scope is to familiarise oneself with the fundamental applications Powder X-Ray Diffraction (PXRD) and to learn how to omit mistakes that affect the quality of the performed measurements and drawn conclusions.

Contact person: Maciej Zielinski (mzielinski@ichf.edu.pl) or Zbigniew Kaszkur (zkaszkur@ichf.edu.pl)

Time requirements: approx. 6 hours
Remarks: The training can involve the analysis of the trainee's crystalline powder sample. Please enrol 4 weeks before the estimated date of the training. The course is addressed to both individuals and small groups. Part of the software is freeware and one can perform the data analysis using his/her own computer.

#171

Title: Application of mass spectrometry for the evolution of the chemical reaction

Abstract:
The following objectives of this laboratory internship are envisiged: (A) separation and structural elucidation of product(s) formed in the nitration reaction of selected aromatics ; (B) differentiation of positional isomers of selected molecules using capillary gas chromatography quadupole/ion-trap mass spectrometry.

Contact person(s): Paulina Wach (pwach@ichf.edu.pl), Dorota Staszek (dorota.staszek83@gmail.com)

Time requirements: one day, 5-6 h

Remarks: Please contact any of the indicated persons at least 3-4 weeks prior to the expected internship date.

#181

Title:
Surface analysis of metallic materials by X-ray Photoelectron Spectroscopy (XPS)

Abstract:
The goal of this laboratory internship is to (1) understanding the phenomenon underlying the XPS method, (2) get familiar with the devices and operating conditions of the VG Microtech spectrometer, (3) measurement of XPS spectra for the metal chosen from Au, Fe, Ni, Mg, Zr (before and after Ar sputtering), (4) identification and quantification of surface elements.

Contact person(s): Tadeusz Zakroczymski, Arkadiusz Gajek

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the indicated persons at least 2 weeks prior to the expected internship date.

#231

Title: Determination of heterogeneous reaction kinetics by scanning electrochemical microscopy

Abstract:
The goal of this laboratory internship is to get familiar with scanning electrochemical microscopy and procedure of determination of kinetic parameters of a model electron transfer heterogeneous process. Reaction rate constant and transfer coefficient will be determined by analysis of current-distance curves of the ultramicroelectrode approaching flat surface at which heterogeneous electron transfer process occur.

Contact person(s): Magdalena Kominiak, Wojciech Nogala

Time requirements: 1 day, 6-8 hours

Remarks: Please contact any of the indicated persons at least 2 weeks prior to the expected internship date.

#241

Title: Belousov-Zhabotinsky reaction; experiments and mathematical modelling.

Abstract:
The project is composed of two parts: experimental and numerical ones.
In the experimental part a student will prepare a medium for Belousov-Zhabotinsky reaction and will observe oscillations in a well stirred system and spontaneously appearing spatio-temporal structures. Next he/she will study the oscillations in droplets containing reagents of Belousov-Zhabotinsky reaction surrounded by a solution of lipids in an organic phase and will establish a relationship between droplet volume and oscillation period.
The numerical part of the project will be concerned with simulations of oscillations and spatiotemporal structures based on simple reaction-diffusion models

Contact person(s): Jerzy Gorecki, Marian Gryciuk

Time requirements: 2 days, 6-8 hours per day

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#251

Title: Vibrational spectroscopy of hydrogen chloride

Abstract:
The goal of this laboratory internship is to (1) get familiar with the technique used for measuring highly resolved ro-vibrational infrared absorption spectra of gaseous samples, and (2) derive selected molecular parameters for hydrogen chloride, based on the detailed analysis of obtained FTIR spectra.

Contact person(s): Thomas Custer

Time requirements: 1 day, 6-8 hours

Remarks: Please contact the indicated person at least 4 weeks prior to the expected internship date.

#271

Title: Fluorescence lifetime measurement by using Time Correlated Single Photon Counting (TCSPC)

Abstract:
This internship aims to show interns about measuring the fluorescence lifetime of fluorophore in solutions. The fluorescence lifetime of a fluorophore in solution can be altered by solvent polarity, solvent viscosity, temperature and presence of oxygen molecules (quenching effect).
During the exercise, an intern will learn basic operation of the TCSPC which includes the TCSPC setup, sample preparation and data analysis. Moreover, an intern will learn about the processes happening after the light excitation which affect the radiative lifetime.

Contact person(s): Gonzalo Angulo, Pakorn Pasitsuparoad

Time requirements: 1 day, 10 hours

Remarks: Please contact any of the indicated persons at least 2 weeks prior to the expected internship date.

#281

Title: Photocatalytic methods for water/air purification

Abstract:
The goal of this laboratory internship is to (1) get familiar with the use of photocatalysts for the oxidation of organic molecules in liquid and gas environments, and (2) use analytical methods such as High Performance Liquid Chromatography (HPLC) and Gas phase Chromatography (GC) during the monitoring of reaction products.

Contact person(s): Juan Carlos Colmenares, Agnieszka Magdziarz.

Time requirements: approx. 2-4 days, 10 -15 hours

Remarks: Please contact any of the indicated persons at least 4 weeks prior to the expected internship date.

#291

Title: Elektronowe widma absorpcji, emisji i wzbudzenia.

Abstract:
Przedmiotem ćwiczenia jest rejestracja widm absorpcji i fluorescencji wybranego chromoforu w roztworze w temperaturze pokojowej, a następnie wykonanie widma wzbudzenia emisji i porównanie go z widmem absorpcji. Szczególny nacisk położony zostanie na zrozumienie warunków potrzebnych do poprawnego zmierzenia widm emisji i wzbudzenia.

Contact person(s): Jacek Waluk, Maria Pszona, Krzysztof Nawara, Natalia Masiera

Time requirements: approx. 1 day; 6-8 hours

Remarks: Please contact any of the indicated persons approx. 2 weeks prior to the expected internship date.

#311

Title: Simulations of chemical reactions at small numbers of molecules

Abstract:
The goal of this laboratory internship is to check how the kinetics of chosen chemical reactions changes depending on the number of molecules. At small numbers of molecules, there occur large fluctuations in concentrations, while at large molecule numbers the fluctuations are negligible. Standard equations of chemical kinetics describe, by definition, mean concentrations and therefore are valid for large numbers of molecules. When the reaction takes place at very low concentrations (eg. in the interior of living cells, where the reactants are often present in quantities of 1, 10, 100 per cell), the equations of chemical kinetics may give incorrect results. The exercise will consist of: 1) Simulation of the reaction system with a ready-to-use computer program using Gillespie algorithm (simulation of the reactions of single molecules a random process); 2) Numerical solution of equations of chemical kinetics using symbolic algebra software; 3) Comparison of both the results to check whether the concentrations calculated using the two methods agree, and if not, how big is the error resulting from the fact that the standard deterministic rate equations do not take into account the randomness of chemical reactions.

Contact person(s): Jakub Jędrak, jjedrak@ichf.edu.pl

Time requirements: 1 day, 4 hours

Remarks: The student should be at least a little bit familiar with the Linux operating system and symbolic algebra programs such as Maple or Mathematica.