

5. 物質・生命化学系 Materials Science and Biotechnology Field			MSB-S5
授業科目名 Course Title	Introduction of Rheological Analyses	単位数 Credit	2.
担当教員 Instructor	Tanaka, Yutaka	開講学期 Semester	Spring.
キーワード Keywords	Keywords. materials chemistry, deformation and flow, linear viscoelasticity.	曜日/時限 Day & Time	Friday / 1st

授業概要 Course summary
<p>Overview.</p> <p>Lecture is concerned with the linear viscoelastic analyses with respect to the deformation and flow in the material chemistry, in terms of both theoretical and experimental methods. As for the experimental methods, static and dynamic measurements are elucidated to configure the acquired data. Data plotting is also incorporated in the exercise of the class.</p>
到達目標 Course goal
<p>(1) To give an appropriate idea about the combination between the viscoelastic functions (VEF) and experimental data.</p> <p>(2) To examine the practical viscoelastic behavior and phenomena so as to derive solutions through the combination of VEF and experimental data.</p>
授業内容 Course description
<p>Class(01)</p> <p>To introduce contents of Lecture, and the related references. Brief outline about the exercise of data plotting and the submission of the plot results through the portal site (webclass and/or google workspace).</p> <p>Class(02)</p> <p>Presentation from participants (Participants are to make presentations according to the quota allcated). Examples of the presentations held last year or previous years are shown.</p> <p>Class(03)</p> <p>1.1 Stress and strain. Definitions and measurement in a rheological test.</p> <p>Class(04)</p> <p>1.2 The Hookean response or the ideal elastic solid: simple deformation.</p> <p>1.3 The Newtonian response or the ideal viscous fluid: simple flow.</p> <p>Class(05)</p> <p>1.4 Models and Greek letters</p> <p>1.5 Questions for the mirror, before the exams</p> <p>Class(06)</p> <p>2.1 Flow curves – the non-ideal behaviour of viscous materials</p> <p>Class(07)</p> <p>2.2 Boger fluids and how elasticity can show up during flow</p> <p>2.3 Dependence of viscosity on polymer molecular weight</p> <p>Class(08)</p> <p>2.4 Shear and extensional viscosity</p> <p>Class(09)</p> <p>2.5 Questions for the mirror, before the exams</p> <p>3 Creep analysis</p>

<p>3.1 What is creep?</p> <p>Class(10)</p> <p>3.2 Principle of operation of a creep test</p> <p>3.3 Time scales and the Deborah Number</p> <p>Class(11)</p> <p>3.4 Linear amorphous polymers creep: time is money, temperature is time</p> <p>3.5 Questions for the mirror, before the exams</p> <p>Class(12)</p> <p>4.1 Linear viscoelastic region</p> <p>4.2 Definition of elastic and viscous components</p> <p>Class(13)</p> <p>4.3 The complex modulus, G' and G''</p> <p>4.4 Frequency sweeps and mechanical spectroscopy</p> <p>Class(14)</p> <p>4.5 Time, frequency, stress/strain... where to begin?</p> <p>Class(15)</p> <p>4.6 Oscillatory temperature sweeps</p> <p>Lectures will be changed according to the circumstances like participants number, their backgrounds etc.</p>
準備学習（予習・復習）等 Preparation / Review
<p>(Pre-class)</p> <p>Read carefully the section of the textbook according to the quota arrangement to prepare its resume.</p> <p>(Post-class)</p> <p>Assignment will be allocated, like equation derivation, data plotting, interpretation of textbook etc.</p>
授業形式 Class style
One on one.
成績評価の方法・基準 Method of evaluation
Notification will be opened in the class.
教科書・参考書等 Textbook and material
Introduction to Rheology. Edited by Marco Berta.
受講要件・予備知識 Prerequisite
Students are expected to be familiar with the basics around the mathematics of high school level, the elementary mechanics and materials mechanics. In addition, students are required to talk about this class prior to the start of the semester.
その他の注意事項 Note
PDF of the textbook, numerical data files can be downloaded through the portal site. Class cancellations will be taken place usually in May, depending on Calendar, due to the research conferences. Notification will be opened prior to the class starts.