

POLYMER SCIENCE AND TECHNOLOGY LABORATORY

Summary

Our everyday life would be unimaginable without polymeric materials. The development in the field of polymer science and technology reached such a scale in the past 130 years, since the discovery of the first synthetic polymeric material, that these days they can be found in every industry and in countless applications. Even if we think only of the packaging materials, different parts of machines, the cases of electrical equipment, the OLED TV screens, medical instruments and biomedical applications, glasses, contact lenses, sealants, textile industry, hoses, rubber industry the average person gets in contact with polymeric materials several times a day. Contrary to this, there is only limited information regarding polymeric materials not only in school textbooks but in the university curriculum. Especially in the field of engineering the properties of polymeric materials should be presented in detail.

The Sapientia Hungarian University of Transylvania realized the importance of polymeric materials in the field of engineering and the lack of specialized personal in the Transylvanian region of Romania. Thus, there are two courses dealing with the properties and processing of polymers in the curriculum of the Mechanical Engineering major.

This book presents laboratory exercises, that supplement the study material and allows the practical understanding of fundamentals through experimentation. The laboratory exercises start with the fundamentals, followed by the presentation of the used instruments, that were designed and implemented by student with the guidance of the author. All lab equipments were the subject of a final project of mechanical or mechatronics engineering students. These accomplishments all follow budget friendly implementations that are suitable for educational purposes, which could inspire other student in the field of engineering.

The book is divided into two parts: the first part deals with the fundamental mechanical properties of polymeric materials, whereas the second part focuses on the major polymer processing technologies. The first laboratory exercise fo-

cuses on the viscous properties of polymer melts, that is followed by the investigation of tensile properties, hardness, toughness and finally the viscoelastic properties.

The second part discusses the major polymer processing technologies, that are presented by connecting them to the recycling process of thermoplastics. There are several advantages in using thermoplastics, however the development of personal knowledge and the legal background with regards to waste management of polymeric materials lags behind the development of new materials and processes. Consequently, polymeric waste has an enormous effect on the environment. The presented laboratory exercises follow the recycling sequence of thermoplastics after the selective waste collection. The first step is grinding, followed by extrusion to prepare a filament from the grinded plastic. The filament is then chopped into small pieces by a machine to produce granulates, that can be used to injection mold a new part from the recycled plastic. Vacuum forming is also presented that is one of the most utilized processes in the packaging industry. The last two laboratory exercises deal with the production of polymeric nanofibers by electrospinning and centrifugal spinning techniques.