



Polymer Technology

Master of Science (M.Sc.)

Information Booklet for Prospective Students



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Introduction

Dear readers,

this booklet shall be an information for both prospective students interested in Polymer Technology and first-year students.

The comprehensive information provided is considered to advertise and recommend the polymer technology field to be both a very attractive subject for studying and promising best chances to the graduates for their future career, whether employed at industry or staying as a researcher. It might help Bachelor graduates to decide positive for a career in the polymer technology field and how to get enrolled as a polymer technology master student at Aalen University (Germany).

The polymer technology industry is growing fast worldwide. Since polymers represent the most significant material class for light weight and high-tech applications, like in

- Aerospace
- Automobile Industry
- Consumer goods
- Medical Application
- Packaging
- Safety
- Sports

The polymer technology industry strives for advanced and sophisticated products engineered for modern world demands and benefits. Consequently, polymer technology expertise is highly asked for.

Studying Polymer Technology promises you personally a great success. By joining an academic institution in Germany you access one of the leading countries for that technology in the world. So go ahead!

I am looking forward to meeting you at Aalen University. Have a good start and all the best for your studies.

*Yours sincerely,
Tobias Walcher*

Prof. Dr.-Ing.Tobias Walcher
Head of programme
Polymer Technology



Studying in Germany

The advantages for foreign students are obvious: German engineering education is among the best in the world - its industry is strong, successful and offers fine opportunities to highly qualified international graduates. Also German industrial companies rank in the world's top position.

A German university degree is recognized worldwide and shows to the employer that a respectable basic education and further technological knowledge was imparted. Practice in the study plays a major role in Germany. Thus in many courses a laboratory is offered. Germany and its system of higher education strives for excellence by providing equal chances to all qualified graduates.

Aalen University and the Federal State of Baden-Württemberg welcome students from abroad in order to intensify intercultural communication as well as commercial and cultural relationships with their home countries.

The studying language in the programme of Polymer Technology is English - German plays a role in the daily life communication.



Studying in Aalen

Aalen is an attractive town with 65,000 inhabitants located in Southern Germany, easily reachable by train, located 80 km east of Stuttgart, 200 km north-west of Munich and 250 km south-east of Frankfurt. The town is situated in a wide valley surrounded by green forests. One of its hillsides even boasts a ski slope during the winter time.

Further attractions are a well-known hot-spring spa, the World Heritage Site Limes and a Mining Museum situated in a former iron ore mine exploited for many centuries. Also there is the local football club VfR Aalen playing in the second best league Zweite Bundesliga.

Local industries have made the Ostalb - the region of Aalen - an economically prosperous one with a very low unemployment rate.

Aalen University was founded by the Federal State of Baden-Württemberg in 1962 as a School of Engineering. Nowadays Aalen University represents a modern educational institution which comprises five faculties:

- Mechanical Engineering & Material Science
- Chemistry
- Optics & Mechatronics
- Electronics & Computer Science
- Management & Business Sciences

It incorporates about 6,000 students with a share of about 15% international students. Beside the student's education, Aalen University has an excellent research capacity and is the strongest University of Applied Sciences in research in the Federal State of Baden-Württemberg. Several technology transfer centers located at Aalen University are in a close collaboration with many industrial partners.

Aalen University is divided in two campuses: The main building is at the Beethovenstrasse, where amongst others the faculty of Mechanical Engineering & Materials Science and the department of Polymer Technology are located. The other campus Burren is only a 5 minutes walk from the main building, where there is the library. Aalen is a perfect place for studying: it offers excellent education and leisure in nature landscape, as well.

Aalen University has currently more than 50 bilateral agreements with universities all around the world with which it exchanges students and academic staff. With its national and international partners, Aalen University carries on continuous cooperative research and development projects.



The Master Programme

The polymer technology industry is growing fast worldwide. Since polymers represent the most significant material class for sophisticated products development and light weight applications. Polymers are a unique class of materials offering a wide range of properties from rigid strong to rubberlike soft. With its outstanding benefits and future developments - which target multifunctionality, safety and sustainable energy saving light weight constructions - polymers guarantee a modern world.

Consequently, advanced education in the fields of polymer engineering and polymer processing must be intensified in order to satisfy the demands of industry and polymer technologist.

Aalen University provides exceptional educational opportunities and understanding. Students of Polymer Technology can gain that high level of engineering knowledge through Aalen University. The goal of the Polymer Technology master programme is

to provide a well-balanced combination of polymer science and technology, theory and practical laboratory training. Since 1969, the Polymer Technology Department of Aalen University has been educating students in Polymer Technology and has shared its scientific expertise in books and publications.

The department's activities range from lectures, seminars, intensive laboratory training to research. The faculty members are recognized not only in Germany but worldwide for their role in polymer technology, research and education. They are also acknowledged for their immense services to the polymer industries.

The aim of our academics and research is the practical application of scientific and engineering principles to develop novel material concepts, new polymeric products, production technologies and troubleshooting capabilities related to the use, processing and recycling of polymers.

Main Features of the Programme Structure Overview

The Polymer Technology programme, its instruction and examinations are given in English. The programme takes in total three semesters, out of which two semesters are lecture and laboratory work and one semester is dedicated for the master thesis. Aalen University offers a learning environment in small course groups. The programme starts twice a year beginning in March and October.

Applications for this highly qualified course programme will be considered from students holding the relevant Bachelor certificate (or equivalent). Students with study degrees in Mechanical Engineering, Production Engineering, Industrial Engineering, Mechatronics, Materials Science, Chemistry or Polymer Technology are very welcome.

Students who successfully graduate receive their Master of Science (M.Sc.) degree in Polymer Technology.

Research opportunities for the master thesis include Polymer Testing, Polymer Design, Processing, Rheology, Compounding, Mould Design, CAD/CAM/ Simulations or Product Development.

The master programme is designated to last **three semesters**.

Two semesters provide concentrated studies of the polymer technology including thorough knowledge of

- polymers, their physical properties and applications,
- polymer product and mould design,
- part simulation, polymer product qualification and evaluation
- processing behavior and the various processing techniques.

One semester is required for the elaboration of the **master thesis**. The thesis can be written either at Aalen University, at one of the international academic partners institutions or in cooperation with the industry. It can be submitted either in English or in German.

Graduates of the M.Sc. programme in Polymer Technology may directly pursue a PhD study or join the industry.



Introduction of Professors

Prof. Dr.rer.nat. Tobias Walcher

Tobias.Walcher@hs-aalen.de
office: 139c main building
phone: +49-7361/576-2260

Expertise and field of R&D:

- Material Science
- Polymer Physics
- Polymer Extrusion
- Multi Layer Film Extrusion
- Film Materials Development

Prof. Dr.-Ing. Achim Frick

Achim.Frick@hs-aalen.de
office: 182 main building
phone: +49-7361/576-2171

Expertise and field of R&D:

- Polymer Materials and Rubber
- Polymer Engineering, Light Weight Design
- Polymer Testing, Thermal Analysis
- Structure Properties Relationship of Polymers
- Micro Processing Techniques
- Multi Component Injection Moulding
- Polymer Tribology

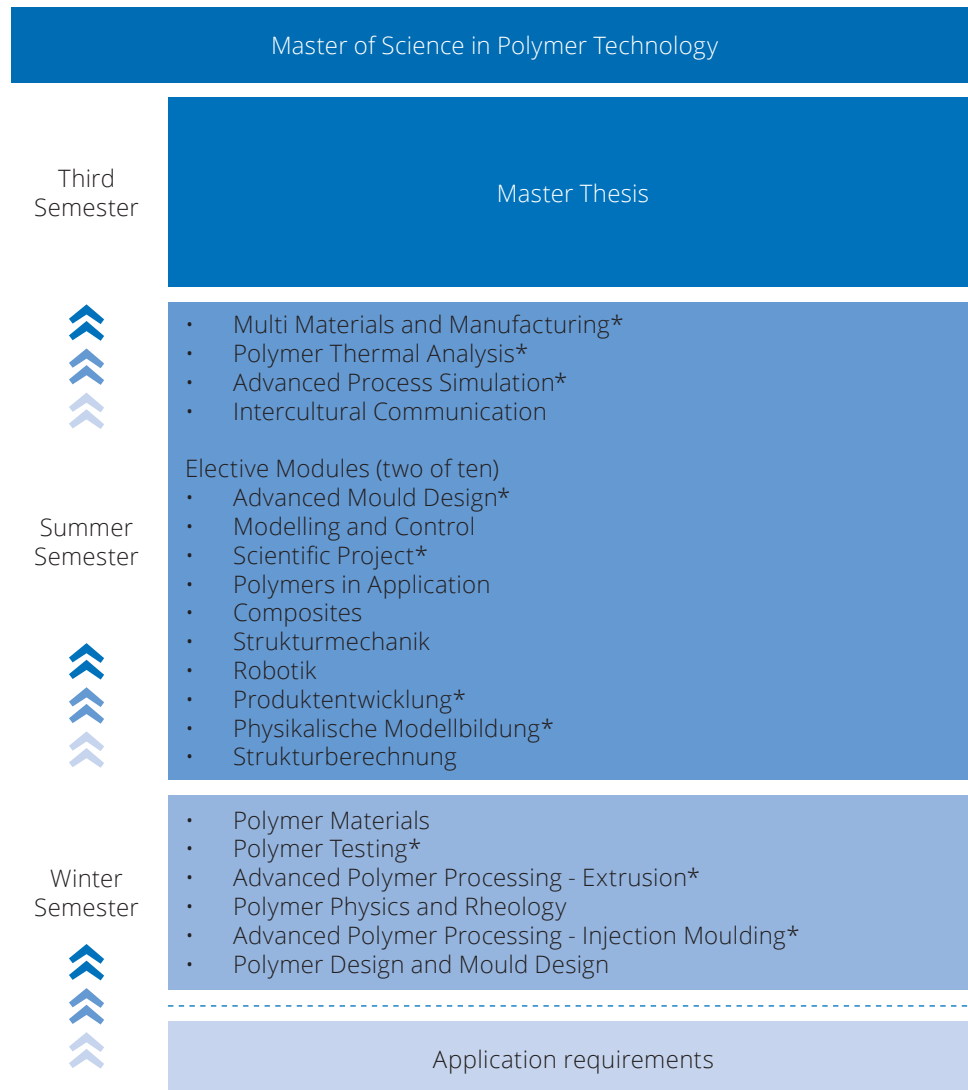
Prof. Dr.-Ing. Harald Kaiser

Head of Programme

Harald.Kaiser@hs-aalen.de
office: 623 main building
phone: +49-7361/576-2194

Expertise and field of R&D:

- Polymer Rheology
- Mould Design
- Filling Simulation
- CAD / CAE



*Modules include laboratory

Description of the Courses

On the following pages all modules and courses will be described shortly to give a little insight in the course and its contents.

Explanation:

| | |
|------------|---|
| SWS | <i>Semesterwochenstunden</i> - weekly hours per semester (2 SWS = 90 min lecture) |
| CP | Credit Point (total course: 90 CP) |

Semester 1

Polymer Materials

4 SWS - 5 CP

Introduction to polymer materials, its synthesis, material built-up, viscoelasticity, additives, filler and reinforcement.

Polymer Testing

2+2 SWS - 5 CP

The module comprises lecture and laboratory.

The basic concepts of testing is taught in the area of Mechanical / Thermal / Chemical and Physical / Optical and Processing Testing.

Advanced Polymer Processing - Extrusion

2+2 SWS - 5 CP

Students get to know the polymer processing method of extrusion, both in theory and by laboratory work.

Polymer Physics and Rheology

2+2 SWS - 5 CP

The goal is to understand the basic concepts of polymer material science and of polymer physics. Also, the engineering scientific basics of highly-viscous liquids such as molten polymers are given.

Advanced Polymer Processing - Injection Moulding

2+2 SWS - 5 CP

Students will gain theoretical and practical knowledge in the field of injection moulding.

Polymer Design and Mould Design

2+2 SWS - 5 CP

Students will learn about polymer part design and injection mould design, how to approach the problems given with respect to the part functionality, the material selection, processing, cost and recycling. A laboratory in simulation increases the theoretical knowledge.

Semester 2

Intercultural Communication

4 SWS/8 SWS - 5 CP

German students are obligated to attend course 14201 whereas international students have to take the course 14202 - to be able to reach this level, the application requirements for German students English B2 level and for English speaking internationals German A2 level is mandatory.

Multi Materials Manufacturing

2+2 SWS - 5 CP

The subject deals with multi layer products and their production. Also the relevant characterisation and qualification methods are given.

Polymer Thermal Analysis

2+2 SWS - 5 CP

Students are introduced into thermal-mechanical testing techniques, and the application of these testing techniques in the identification and study of polymers. The role of these analysis methods in the evaluation of the lifetime and performance of the polymeric material is also emphasized.

Advanced Process Simulation

2+2 SWS - 5 CP

Students will find out about the topics of optimization of the mould design and process optimisation with 3D simulation programs.

Elective Modules (two of ten)

Advanced Mould Design

2+2 SWS - 5 CP

Optimization of the tool quality for the improvement of the process ability as well as gating types are introduced to the students.

Modelling and Control

2+2 SWS - 5 CP

Students will learn about material and process simulation and suitable materials for polymer processes. Furthermore they are taught the monitoring of the process related characteristics.

Scientific Project

2 SWS - 5 CP

Students can choose the topic of their project out of five categories: Engineering & Quality / Simulation / Processing / Control Engineering / Testing

Polymers in Application

4 SWS - 5 CP

In this course the focus is directed to engineering with polymeric materials.

Composites

4 SWS - 5 CP

Materials and construction of lightweight parts.

Strukturmechanik (German elective module)

4 SWS - 5 CP

Die Lehrinhalte umfassen die Grundlagen der Elastizitätstheorie, die Statik spezieller Tragwerke, die Stabilität sowie das viskoelastische und plastische Verhalten von Werkstoffen.

Robotik (German elective module)

4 SWS - 5 CP

Die Lehrinhalte umfassen die Anwendung und Einsatzbedingungen von Robotern und Robotersystemen, mögliche Roboterarten sowie die Robotersteuerung und -regelung einschließlich der zugehörigen Aktorik, Sensorik und Messtechnik für Roboteranwendungen.

Produktentwicklung (German elective module)

2+2 SWS - 5 CP

Die Lehrinhalte umfassen die Werkzeuge zur digitalen, rechnergestützten Produktentwicklung und -fertigung (Additive Manufacturing). Die Vorlesung wird durch Projektarbeiten ergänzt.

Physikalische Modellbildung (German elective module)

4 SWS - 5 CP

Die Lehrinhalte umfassen die Modellbildung und Simulation dynamischer Systeme und beinhalten Modellierungs- und Simulationsübungen im Matlab/Simulink.

Strukturberechnung (German elective module)

4 SWS - 5 CP

Die Lehrinhalte umfassen den Produktentstehungsprozess für Leichtbaukomponenten und -systeme und die Bewertung von Bauteilen und Leichtbaustrukturen mittels FEM und Topologieoptimierung in Abaqus.

Semester 3

Master Thesis

30 CP

With the Master Thesis students demonstrate their ability to work scientifically on an open question subject independently. Within a given time period they apply the scientific methods and the knowledge and skills acquired during their course of studies.



Facilities & Laboratories

At Aalen University and in the department of polymer technology there are several laboratories in which students can gain practical experience.

Especially in the field of polymer technology the following facilities are in use:

Polymer Testing

- **rheological properties**
 - capillary viscometer test
 - rheometer test
 - melt indexer
- **mechanical properties**
 - tensile, compression and flexure test,
 - relaxation and creep test
 - tensile and flexure impact test,
 - hardness test
- **thermal properties**
 - Vicat softening point test
 - differential scanning calorimeter (DSC)
 - dynamic mechanical analyzer (DMA)
 - thermo-gravimetric analyzer (TGA)
 - dilatometer (TMA)
- **chemical / physical properties**
 - FT-NIR (near infrared) spectroscopy
 - cryo-microtome cutting
 - microscopy (light / SEM)
 - moisture test

Polymer Processing

- injection moulding
(single/two component, gas assisted)
- extrusion (mono/multi layer, blow film)
- blow moulding
- compression moulding
- thermoforming

Simulation & Software

- Autodesk Moldflow Insight
- Moldex 3D
- VISI
- CATIA
- Creo (Pro Engineer)
- ABAQUS FEM
- Labview
- MatLab
- Origin

International Relations

The Department of Polymer Technology cooperates especially with the following universities and has multiple contacts to further national and international academic institutions:

Europe

Finland

- North Karelian Polytechnic, Joensuu

Malta

- University of Malta, Msida

North Ireland

- Queen ´s University of Belfast

Poland

- Silesian University of Technology, Gliwice

Portugal

- Universidade do Minho. Braga

Spain

- University of Vigo
- Universidad Polytechnica de Valencia

UK

- University of Warwick,
School of Engineering, Coventry

Africa

Egypt

- German University of Cairo

Asia

Pakistan

- National University of Sciences and
Technology, Islamabad

Thailand

- King Mongkut's University of Technology
North Bangkok



Experiences of Former Students



» I'm involved in Rajoo Engineers Limited (India), a leading plastic extrusion machinery manufacture with installations in 60 countries. I am working as a production head of all the hot parts of the machinery like die, extruder and moulds, thus in a very close interaction with the design department of the company. «

Ustav Doshi

The Indian graduate of 2010 wrote his thesis on HFFR Wire and Cable compounding for Low and Medium Voltage applications at the Lucobit AG, Cologne (Germany).

» Someone has said, "your attitude determines your altitude".

Therefore, I would thank to all the faculty of Aalen University who worked hard along with the students for delivering the knowledge and skills in the field of polymers. The course was very well designed in which the theoretical knowledge was coupled with the practical exposure in the form of extensive laboratory work. All of such effort of the faculty and working environment at Aalen boosted me to adapt the right attitude towards learning and achieving the goals in life. «



Dr. Eng. Ahmad Nawaz Khan

The Pakistani wrote his thesis at the GKN Driveline International GmbH, Lohmar (Germany), and finished his studies in 2005. Now he is working as an Assistant Professor in the Department of Materials Enginee School of Chemical and Materials Engineering at National University of Sciences and Technology (NUST), Islamabad (Pakistan).

» I have just moved from Pakistan to Denmark. But I have had worked ever since graduating from Aalen University in the areas of product development, production, mould & dies manufacturing, and engineering departments in the home appliances industry. My last designation was Manager Engineering and Technology. Moreover, based on my MSc in Polymer Technology I was able to get PhD scholarship in the UK. «

Dr. Kashif Kamran Ahmad

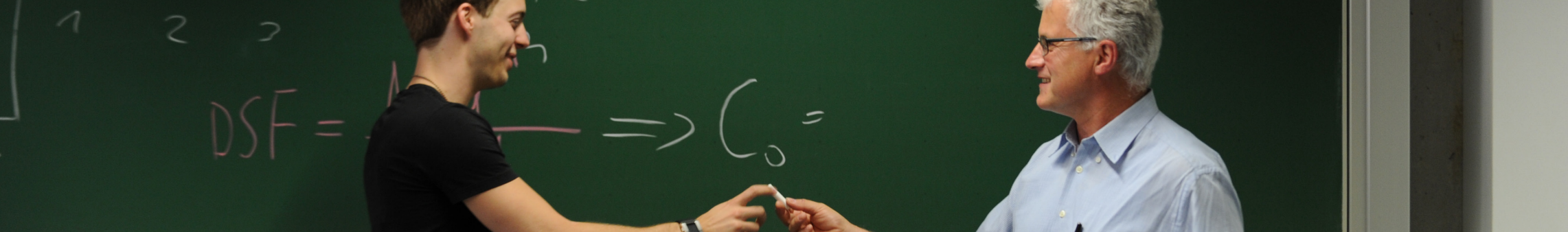
In 2005, the Pakistani finished his thesis on micro-injection moulding for Varta Microbattery GmbH, Ellwangen (Germany).



» Aalen is area of outstanding natural beauty and this was my first opportunity in Aalen University to study in the field of Polymer Technology which i still working continue in the research of Polymer and PolymerComposites in my home country. «

Assoc. Prof. Dr.-Ing. Suchart Siengchin

He finished his studies at Aalen University in 2002, the Thai is now working as President of KMUTNB at the King Mongkut's University of Technology, North Bangkok (Thailand).



Admission

General Admission Requirements

The admission policy of Aalen University requires of applicants for the programme

- their first professional degrees (with 2.5 or better - German grading system),
- additional skills and knowledge,
- all to be of good quality.

The scientific requirement for student's enrollment is a Bachelor degree (B.Sc., B.Eng.) in Mechanical / Production / Industrial Engineering, Mechatronics, Materials Science, Chemistry or Polymer Technology.

It is also required that students be highly motivated, strongly interested and have a good command of the English language.

Furthermore basic skills in German are required to apply for the master programme. This requirement focuses mostly on the daily life as this takes place in German society.

After all applications are submitted at the end of application deadline, a committee of the programme will decide about the admission and inform applicants immediately. The only crucial factor - next to the compliance of all requirements given - is the average of marks achieved in the Bachelor. Depending on qualification and possibly

further training, the committee may improve this average mark up to 0.3 points (German mark system).

The application in detail:

- Application form (see webpage)
- Certificate for the University Admission* (e.g. high school certificate)
- Certificate of first Professional Degree* (e.g. Bachelor certificate)
- Curriculum Vitae
- Certification of language skills*:
 - German (A2 level; if not native speaker)
 - English (B2 level; if not native speaker)
- Residence permit* (if not German resident)
- Certificate of Health Insurance*

* documents need to be authenticated

The application needs to be sent to the university's Admission Office until the application deadline (see next page):

Aalen University
Admission Office
Polymer Technology
Beethovenstr. 1
D - 73430 Aalen
GERMANY

Programme Schedule

Programme starting in October

| | |
|-----------------------|--|
| May | Start of Application Procedure |
| July 15 th | Application Deadline |
| End of July | Decision on Final Admission |
| September | First-Year Arrival; Introduction Programme |
| Beginning of October | Start of 1 st studying semester |
| February | Exams and Evaluation |
| Mid March | Start of 2 nd studying semester |
| July | Exams and Evaluation |
| August - January | Master Thesis |

Programme starting in March

| | |
|---------------------------|--|
| October | Start of Application Procedure |
| November 15 th | Application Deadline |
| End of January | Decision on Final Admission |
| February/March | First-Year Arrival; Introduction Programme |
| Mid March | Start of 1 st studying semester |
| July | Exams and Evaluation |
| Beginning of October | Start of 2 nd studying semester |
| February | Exams and Evaluation |
| March - August | Master Thesis |



Financial Aspects

Fees

Non-EU students: studying fees 1.500 EUR per semester; there are several exceptions, please consider the checklist.

Service and enrollment fees of € 147 per semester. These are

- student contribution € 65
- administration fees € 70
- contribution for the student representative organizations € 12

Housing and Living

The International Relations Office helps students find accommodations. Students can choose between private accommodation and student residence halls.

Living Costs

The estimated minimum costs of living, e.g. for accommodation, food, obligatory medical insurance are approx. € 700 per month. This is also the amount of money the German Embassies needs students to state with their application.

- Accommodation (between € 200 to € 400 per month)
- Food (approx. € 150 to € 200 per month)
- Health Insurance

(approx. € 75 per month)

- Liability Insurance (approx. € 5 per month)
- Immigration office, visa prolongation (about € 80)
- Transportation with SemesterTicket 2 (€ 108 per semester, if needed, for further information check p.23)

For more information on financial aspects and how best to find a flat, please check our homepage for FAQ:

www.hs-aalen.de/ptc



Visa Regulation & Insurances

Visa Regulations

Depending on their home country, international students will require a visa and a residence permit. Visas are issued only by the German Embassies in the student's home country. To obtain the visa, an official letter of acceptance from the Aalen University is needed. In addition to the letter of acceptance, the German Embassy requires proof of sufficient funding for the period of study abroad, usually about € 600 per month. Please allow at least four to six weeks to obtain the visa from the Embassy. At Aalen, all international students will have the legal status of a full-time student and will obtain a residence permit from the local Immigration Office (City of Aalen) for their period of study in Aalen.

Furthermore, when applying for a visa at the German Embassy, international students will need a financial statement proving that they have sufficient funding for the entire period of study abroad - usually about € 700 per month.

For further information, please check the homepage of the German Federal Foreign Office:

www.auswaertiges-amt.de

Health Insurance

Krankenversicherung

All students have to provide proof of adequate health insurance during their studies. International students are advised to check with their health insurance company whether or not they will cover costs in Germany and which forms they provide. For the confirmation an international form (e.g. E 111) is accepted but needs to be confirmed by the public health insurance company (AOK) in Germany.

In case the international insurance company does not cover costs, students are required to purchase health insurance in Germany.

Liability Insurance Haftpflichtversicherung

This insurance is recommended however not compulsory. When living in Germany or working at the university, having laboratories during the studies, it's best to be insured for any damage done.



Student Services & Associations

International Relations Office Akademisches Auslandsamt (AAA)

The IRO is responsible for organising exchange programmes. It aims to help international students with any problems they may have. At the beginning of each semester, it organises orientation weeks for international students (and German friends). During the semester, it arranges company visits and trips to various places of interest (information on the IRO Notice Board).

Link to IRO:



Student Service Organisation Studentenwerk

The Studentenwerk is the body that runs some student services. When enrolling at a German university students have to pay a contribution.

For example, students receive benefits when buying lunch at the refectory (Mensa) or for snacks and drinks at the cafeteria. Also the Studentenwerk offers social consulting.

Library Bibliothek

The library is located on the campus Burren - only a 5 minutes walk from the university's main building where the Polymer Department is located.

On three floors the library offers several subject-specific books as well as some novels or books on foreign languages. Furthermore with their computer account, students are offered a multitude of e-books.

Language Centre Sprachenzentrum

The university's Language Centre offers various language courses which mostly take place parallel to the semester.

As there are many courses offered, Aalen University cooperates with the local adult education centre (Volkshochschule).

Student Union

Aalen University has three different Student Unions: **AStA**, **UStA** and **StuRa**.

Their offices are located in the main building. Different events (film showings, concerts, parties) and sports activities (e.g. volleyball, football, tennis) are organised.

Interested students are welcome to join the union UStA to find out more!

Link to Aalen City Guide:



Transportation in Aalen

Since 2012, the local transport association OstalbMobil and Aalen University are collaborating: all students have the so called **SemesterTicket 1** included in their student contribution. With this ticket they are allowed to drive buses and local trains for free each day from 6 p.m. as well as on Saturdays, Sundays and holidays in the region of Aalen. Furthermore two additional Tickets can be bought:

SemesterTicket 2 increases the timeframe of the ticket to a 24/7-possibility.

SemesterTicket 3 increases the range of drive from the local region up to Stuttgart, Schwäbisch Hall and Heilbronn.

Aalen's train station is located 30 minutes by

walk from the university but there are buses connecting the station with the university!

For more Information: www.ostalbmobil.de

Activities in Aalen

At the City Council (Rathaus, Marktplatz 30), Tourist Information (Marktplatz 2) - both located in Aalen's historic city centre - or online (www.aalen.de), students can obtain information about the various activities to be done in Aalen. E.g. which clubs (sports and cultural) there are or which cultural events will take place.

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