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Dieter Schuöcker
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Welcome Address

Eduard Mainoni, State Secretary, Austrian Government

Let me first welcome Prof. Schuöcker on behalf of the organizers of this conference and thank him for his opening words! Esteemed Representative of the Upper Austrian Regional Parliament! It is a great pleasure for me to welcome you here at the lovely village of Gmunden at the XVI International Symposium on Gas Flow, Chemical Lasers, and High-Power Lasers. I appreciate the honour to open your conference especially since Gmunden is quite close to the place where I was born. Anyway, I do hope that this pleasant environment will promote the creativity and fertility of your ideas and debates.

Today, most of the European and industrialised countries face an urgent need to restructure their economy and society in order to meet the challenges of the 21st century. Modern societies have to realise higher economic growth through improved competitiveness and productivity. They have to adapt to the changing economic realities brought about by the globalisation of markets and the tremendous pace of technological change. Our innovation performance is crucially dependent on strengthening investment in and the use of new technologies. Thus research, technology, and innovation policy addressing the complex system of our knowledge-based economies have become a top priority on the political agenda all over the world.

Looking at the attendance list of this conference, covering Americans, Asians, Europeans, and Russians, I might say that the audience here is a perfect proof of this globalised knowledge society.

Yet stressing the national and regional aspects, let me make some remarks on the Austrian landscape in general and especially on laser technology, since this is the subject of the conference. In recent years Austria has managed to catch up considerably in terms of research, technology, and innovation policy. Over the last five years, the research quota in Austria has risen from 1.9 to 2.43 percent (share of GDP) and is now significantly above the EU average. Important structural reforms such as the establishment of the Austrian Research Promotion Agency (FFG) and the reform of the Fund for the Promotion of Scientific Research (FWF) assure greater efficiency in the innovation system. Today these results show that Austria has the prospect of catching up with the top European and global performers in research, technology, and innovation.

One of the most innovative fields of research is laser technology. This kind of technology has a long history in Austria. Even more, I might say that Austria has a proven historical track record in laser technology. Considerable contributions toward the invention of laser light have been made by Austrian researchers:

- wave mechanics and theory of waves by Schrödinger and Doppler
- invention of feedback effects by Meißner
- theory of gas flows by Mach
- theory of optical fibres by Kogelnik.

However, looking into the present there is no need to hide either:

- Austrian universities have been in the vanguard of the first industrial gas laser.
- Universities and Austrian companies play a key role in the area of optical pulses in the 10-femtosecond range.
- Several companies are in the global lead concerning hybrid welding technologies or laser based engraving.

Until now Austrian research activities carried out in the laser domain have significantly increased over the years and spread over several initiatives, programmes, and instruments. The so-called General Programme of the Austrian Research Promotion Agency has funded important industrial R&D projects over decades. Various aspects of laser technologies are covered in competence centres and labs dealing with new materials. Under the roof of the Austrian Nano Initiative and the top-down programme FIT-IT, several contracts have been signed in laser-related areas such as optoelectronics or photonics. Moreover, I should mention the Austrian Laser Association, Argelas, who — together with the Vienna University of Technology — is the organiser of this conference. Argelas is a national platform reassembling some 60 industrial key actors. Last but not least, let's not forget the European Programmes such as IST or NMP, where Austria has exhibited an extraordinary performance in laser related domains.

Being in such a good company with excellent experts from all over the world, it's needless to stress the importance of laser technologies to industrial applications.
As you all know better than me, its impact is considerable both in terms of sustainability and in terms of bandwidth.

As far as we can assess the amount of application areas for laser in Austria it counts up to approximately 2,000 different industrial actors, with a clear tendency of enlargement to various sectors:

- high-tech applications in the sector of mechanical
- electrical or process plant engineering
- automotive industries
- health technologies
- consumer electronics
- microelectronics and so on and so forth, enabled or empowered by laser technologies.

Austrian global players such as Berndorf, Böhler-Uddeholm, Electrovac, Fronius, Magna, Palfinger, Swarovski, Trodat or Voest Alpine Stahl — to name just a few in random order — benefit in their daily business from the effects and the stimulus of highly bundled light.

Coming to an end, I may express my conviction that the future of laser technologies is represented by you and your work. In this sense I would like to thank you for your attendance and your engagement in preparing this meeting. I wish you creative and inspiring discussions, and interesting and enriching days in Gmunden.

Introduction

High-power lasers, as of carbon dioxide type, Nd:YAG lasers, diode lasers, excimer lasers and chemical lasers as chemical oxygen iodine lasers (COIL), show wave lengths that span from the range of the far infrared above 10μm down to infrared close to the visible range and ultraviolet, whereas the wavelength is most important for the absorption and transmission of laser radiation by a certain material. The beam power reaches up to megawatts in the case of COIL lasers and the focus size can become as small as 10μm in the case of the most recent Nd:YAG lasers, whereas the last two properties of the beam power and the focus size are of crucial importance for the applications in material processing, since the focus size determines the sharpness of the beam tool and the beam power the force acting on the tool. Applications of these lasers besides material processing as already mentioned can be found in energy transmission, combustion and propulsion.

All these topics were covered during the XVI International Symposium on Gas Flow, Chemical Lasers, and High-Power Lasers which took place in Austria in September 2006. Nearly 200 presentations were given by many world recognized scientists but also by young and upcoming colleagues. Most papers show high quality. Collectively they cover a variety of topics, being well distributed over the field of the conference as defined above.

There were numerous highlights among these papers, for instance lectures that discussed the competition between the two most recent types of industrial lasers, namely, disc lasers and fibre lasers, whereas beam parameter products have been achieved that are considerably smaller than for conventional high-power lasers and allow new applications such as remote welding or the generation of three-dimensional structures with very high quality by melting down and welding powderised materials.

Further highlights in the field of material processing applications were new hybrid processes where conventional technologies are advantageously combined with the impact of high-power lasers as for instance in welding or metal forming.

Besides material processing further fascinating topics treated at the conference were propulsion with lasers, the ignition of combustion processes as in motors and also applications of a new one-megawatt COIL device for energy transmission in defence.

Summarising, the actual conference demonstrates nice progress in the field of high-power lasers and their applications and contributes to the worldwide diffusion of new results to the scientific community.

Dieter Schuöcker