



Participant Profile

for the
Turkish-German Strategy Workshop 2006
TÜBİTAK Marmara Research Center,
Istanbul- Gebze Turkey
13 – 15 December 2006



International Bureau (IB)
of the Federal Ministry of
Education and Research
(BMBF)

1. Contact details and personal information

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¹ **Role/function** e.g. working group leader, managing director, postdoc, PhD etc.

² **Organisation type** e.g. university, research institution, small and medium enterprise (SME), industry etc.

Working Group:	<input checked="" type="checkbox"/> 1 Material Technologies <input type="checkbox"/> 2 Biotechnology, Genomics and Food <input type="checkbox"/> 3 Energy <input type="checkbox"/> 4 Information and Communication Technologies <input type="checkbox"/> 5 Environmental Protection, Climate Change and Sustainable Development
Areas of activity:	<input checked="" type="checkbox"/> research <input type="checkbox"/> technology development <input type="checkbox"/> demonstration <input type="checkbox"/> training <input type="checkbox"/> dissemination <input type="checkbox"/> other:
Keywords characterising your area of research:	Please choose the appropriate key words (max. 5) from the following list: http://www.cordis.lu/fp6/keywords 06.02.01.01.03.02.00
Expertise, technologies and infrastructures available in your institution:	Research activities / expertise: Processing and designing of lightweight structures Methods: Powder metallurgy and modelling Key technologies: Ceramic reinforced Al foams and Ti6Al4V foamy spinal cages Infrastructures: Powder processing laboratory, mechanical testing, characterization and modelling software Key publications: <i>M. Güden, S. Yuksel</i> Compression behavior of SiC-particulate foams produced by foaming from powder compacts <i>J. Materials Science</i> 41 (2006) 4075-4084. <i>S. Elbir, S. Yılmaz, A. K. Toksoy, M. Güden, I. W. Hall</i> SiC-particulate aluminum composite foams produced by powder compacts: foaming and compression behavior, <i>J. Materials Science</i> . 38 (2003)4745-4755. <i>M. Güden, H. Kavi,</i> Quasi-static axial compression behavior of constraint hexagonal and square-packed empty and aluminum foam-filled aluminum multi-tubes. <i>Thin-walled structures</i> (in press) <i>L. Aktay, A K. Toksoy, M. Güden</i> Quasi-static axial crushing of extruded polystyrene foam-filled thin-walled aluminum tubes:experimental and numerical analysis <i>Materials and Design</i> 27 (2006) 556-565. <i>S. Yüksel, M. Güden, A. Taşdemirci, M. Tanoğlu</i> Effect of aluminum closed-cell foam filling on the quasi-static axial crush performances of glass fiber reinforced polyester composite and aluminum/composite hybrid tubes. <i>Composite Structures</i> (in press). <i>Guden M, Celik E, Akar E, Cetiner S.</i> Compression testing of a sintered Ti6Al4V powder compact for biomedical applications <i>Materials Characterization</i> 54 (2005) 399– 408. <i>M Güden, E. Çelik, S. Çetiner, A. Aydın,</i> Metal Foams for Biomedical Applications: Processing and Mechanical Properties <i>Advances in Experimental Medicine and Biology</i> 553(2004)257-266.



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2. Past and present research collaborations

Are you familiar
with the European
Framework
Programme?

Yes

No

- with Framework Programme 5
- with Framework Programme 6
- with Framework Programme 7

EU-projects you are
involved in:

Past projects

Present projects

Programme title / contract number / title / acronym / your function
(coordinator / partner / contractor)

Other international
collaborations:

Wave Propagation in Multi-Layered Materials. NSF (National Science Foundation USA-TÜBİTAK (Scientific and Technical Research Council of Turkey) international joint project, MİSAG-NSF-7 (2003- continue)

Name(s) and
contact details of
potential partners:

If you would like to suggest the participation of particular partners from the partner country based on existing contacts or collaboration experience, you are welcome to indicate their names and contact details below:

3. Presentation at the Workshop

I will give a presentation at the workshop (approx. 10 min.) to present my institution, my expertise, and my collaboration interests. The contents of my presentations is summarised below (max. 1 page).

Aluminum (Al) foams of closed and open cells are the materials of increasing importance since they have good energy absorption capabilities combined with good thermal and acoustic properties. Al foams can convert much of the impact energy into plastic energy and absorb much more energy than bulk metals at relatively low stresses. It has also been shown that when tubular metallic structures are filled with light weight Al closed cell foams; there exists an *interaction effect* between tube wall and foam filler. It was shown that there was a critical total tube mass and the corresponding critical foam density and/or plateau stress above which the use of foam filling becomes more efficient than empty tube. Therefore, the foams of higher plateau stresses should be preferred in foam filling applications over the foams of lower plateau stresses at similar densities, when the efficiency is considered. This may be achieved by adding ceramic particles including natural nanostructures diatom frustules and/or whiskers to the foamed metal microstructure similar to the metal matrix composite matrices. The proposed project is aimed at determining the effects of SiC-particulate and whisker and alumina and magnesia particulate additions derived from diatomaceous SiO₂ on the plateau stresses and the effects of particle percentages and sizes on the foaming behavior and foam stability in *foaming from Powder compacts* (FPC) Al foam processing. The use of natural diatomaceous earth is aimed at reducing the processing cost of the foam production. The proposed project is a continuation of the previous projects. The project targets the optimization of the foaming behavior and mechanical properties in Al foams produced by FPC method through systematical and sophisticated experiments and FE package programs. At the end of the project the selected foam microstructures will be prepared in pilot sizes and will be tested in hexagonal and squared packed multiple tube crush boxes. In the final step of the project the foam filled crush boxes geometries will be



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optimized. The final target is to design novel crush boxes with known crushing behavior.

Porous implant components based on biocompatible metallic materials (e.g. Ti and Ti6Al4V) are expected to provide better interaction with bone. This is partly due to higher degree of bone growth into porous surfaces and higher degree of body fluid transport through three-dimensional interconnected array of pores, leading to improved implant fixation. Furthermore, relatively low elastic modulus of porous metals as compared with those of bulk metals is expected to reduce the extent of stress shielding, which causes well-known *implant loosening*, and hence to prolong implant life-time. Open cell Ti foams potentially to be used in biomedical applications were previously prepared using a powder metallurgical process known as space holder method. The method allows a direct near net-shape fabrication of foamed implant components having elastic modulus comparable with that of natural bone and with a relatively homogeneous pore structure and a high level of porosity (60-80%) . The compressive yield strength of sintered Ti compacts was however found to be lower than that of the human cortical bone due to the relatively low yield strength of Ti powder. One way of increasing the yield strength of powder compacts is to use biocompatible stronger Ti alloy powders. This experimental study is therefore conducted to produce stronger sintered powder compacts that can potentially be used in biomedical applications (load carrying implants) including human cortical bone replacement. The experimental work focused so far on (a) the preparation of Ti6Al4V compacts with various porosity and pore sizes and (b) the determination of compression mechanical properties of compacts as function of porosity. The final aim of the work was the optimization of the process and properties to satisfy the bio-mechanical design requirements for certain implants.

I agree with the publication of my data on the Workshop website!

PLEASE FILL IN THIS FORM UNTIL 22 SEPT. 2006 AND RETURN IT TO:

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