COST 526

"Automatic Process Optimization in Materials Technology"

(APOMAT)

Half-Yearly Report

1. Reporting Period	**1.7.2002 – 31.12.2002**
Project title	Formulation of Objective Functions for Estimating Fatigue Damage of Cold Forging Tool Steels at Micro Scale
Project leader Organization	Dr. Tomaž **Rodič** Faculty of Natural Sciences and Technology, University of Ljubljana, Slovenia.
Main collaborators involved	C3M

2. Funding Situation	
Amount of money received specifically for COST	2.9 kEuros
Other resources partially used for the project	0 kEuros

3. International Collaboration (mention group and type of work done in collaboration during the reporting period)
Participation in the Working Group Meeting in Budapest + project progress report ❒ YES ➨ ❒ NO
LMT-ENS Cachan (France) – Micromechanical modelling of materials

4. Industry participation (mention name of companies and work done in collaboration during the whole project)
Iskra-Avtoelektrika. Investigations of parameters influencing service life of tooling systems

5. Meetings, visits, exchange of scientists, short-term scientific missions	**Location, date**
Working Group Meeting Meetings with Iskra-Avtoelektrika	Budapest, Nov 28/29, 2002 Ljubljana, Nova Gorica, 2 meetings

6. Progress within the reporting period
In the reporting period a micromechanical model for ultra high strength tool steel material has

been developed. The material is produced by powder metallurgical processing route and is considered as a Metal Matrix Composite that consists of martensitic matrix and spherical carbides. The interactions between the matrix and carbides illustrated in Figures 1 and 2 have been modeled by considering cyclic stress situation at the critical location of a cold forging die presented in Figure 3.

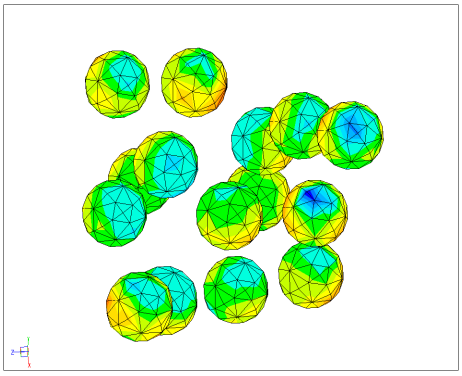


Fig. 1 Distribution of carbides

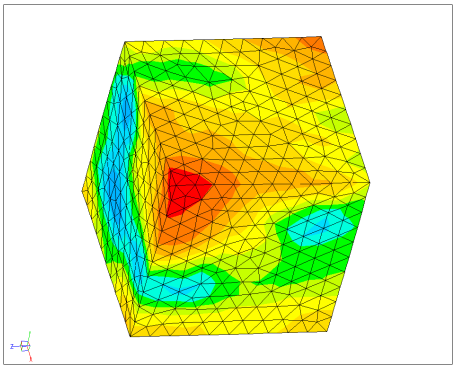
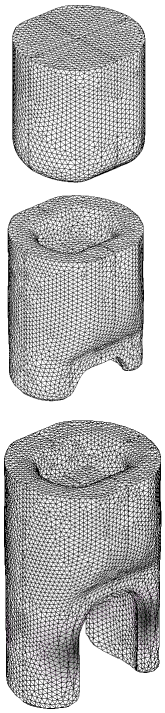


Fig.2 Tractions on the matrix boundary



Loads derived from the FE simulation of cold forging operation have been repetitively applied to the die insert. The cyclic response of the die has been analysed by an elasto-plastic model considering istropic and kinematic hardening coupled with damage.

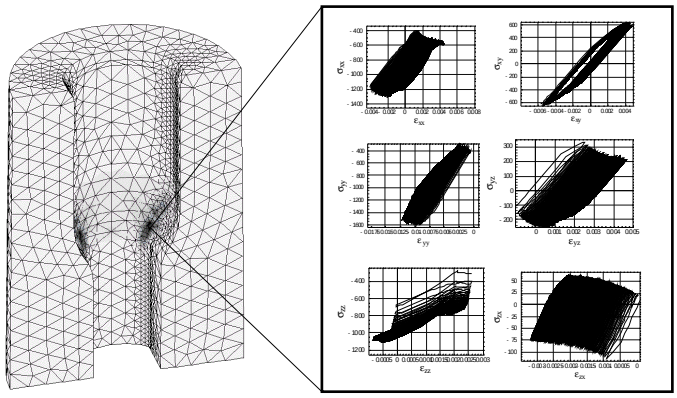


Fig. 3 Cyclic stress-strain path at the critical location of the cold forging die

7. List of publications

a) Published

T. Rodič, J. Korelc, M. Dutko, A. Pristovšek: Sensitivity analysis of cold forging dies with respect to parameters influencing fatigue damage due to cyclic plasticity, V: M. Pietrzyk, Z. Mitura, J. Kaczmar (editors), "*The 5th International ESAFORM Conference on Material Forming*", Akadeimia Góeniczo-Hutnicza Kraków, 2002; ISBN 83-7108-098-0; Krakow, Poljska, 14.-17. april. 2002.

I. Grešovnik, T. Rodic, "Practical considerations regarding optimisation of shape in forming processes", V: M. Pietrzyk, Z. Mitura, J. Kaczmar (editors), "*The 5th International ESAFORM Conference on Material Forming*", pp.. 27-30, Akadeimia Góeniczo-Hutnicza Kraków, 2002;

ISBN 83-7108-098-0; Krakow, Poljska, 14.-17. april. 2002. I. Grešovnik, T. Rodič, S. Stupkiewicz, D. Cukjati, "*Application of Optimisation Techniques in Metal Forming", "34th Solid Mechanics Conference – volume of abstracts",* str. 109-110, Institute of Fundamental Technological Research, Polish Academy of Sciences (press: ATOS Poligrafia-Reklama), 2002; Solmech 2002, Zakopane, Poland, 2.-7. september 2002. D. Markovič: Testing the new micro-macro strategy. Internal report
b) Submitted for publications
c) In preparation