EFFECTS OF IMPACT VELOCITY AND STRESS CONCENTRATORS IN TITANIUM ON FAILURE BY ADIABATIC SHEARING

Second Interim Report
(Nov.18/2000 – Feb.17/2001)

Principal Investigator: J.R.KLEPACZKO

UNITED STATES ARMY EUROPEAN RESEARCH OFFICE
LONDON, UK

R&D 9022-AN-01

CONTRACT N°: N68171-00-M-5984

Contractor:

Laboratory of Physics and Mechanics of Materials
ISGMP, UMR – CNRS 7554
METZ UNIVERSITY
F-57045 Metz, France

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 6,2001	Interim, November 18/2000-February 17/2001

4. TITLE AND SUBTITLE
EFFECTS OF IMPACT VELOCITY AND STRESS CONCENTRATORS IN TITANIUM ALLOYS ON FAILURE BY ADIABATIC SHEARING

5. FUNDING NUMBERS
N68171-00-M-5984

6. AUTHOR(S)
J.R.KLEPACZKO

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

METZ UNIVERSITY – ISGMP
LABORATORY OF PHYSICS AND
MECHANICS OF MATERIALS

METZ UNIVERSITY
ISGMP-LPMM
ILE DU SAULCY
F-57045 METZ cedex, FRANCE

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

USA RDSG-UK, AERONAUTICS AND
MECHANICS BRANCH
Dr. Sam SAMPATH

223 OLD MARYLEBONE RD.
LONDON NW1-5TH, UK

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
DISTRIBUTION UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 Words)*

This Interim Report covers the contract period from Nov.18/2000 to Feb.17/2001 (second period of three months). During this period a series of shear tests on fast servo-hydraulic testing frame with three specimen geometries have been completed. That is the following geometries of notches were applied: U-geometry, V-geometry and I-geometry. The standard geometry with a square notch was tested during the first interim period. The specimen geometries are specially design to increase the stress concentration before triggering an adiabatic shear band. The material tested was Ti-6Al-4V, delivered by the ARL-APG-AMSRL. This series of tests was limited to relatively low nominal strain rates, from 10E-3 1/s to 10E+3 1/s. Analysis of the oscillograms obtained with those tests are almost finished.

The experimental setup for the direct impact loading has been improved and experiments are started and are continued. The range of the nominal strain rates covered by the direct impact technique is from 10E+3 1/s to ~10E+5 1/s.

14. SUBJECT TERMS
ADIABATIC SHEAR BANDS, TITANIUM ALLOY Ti-6Al-4V,
STRESS CONCENTRATORS IN IMPACT, DYNAMIC SHEAR FAILURE

15. NUMBER OF PAGES
03

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASIFIED	UNCLASIFIED	UNCLASIFIED	

EXTENDED ABSTRACT

During the second period (three months from Nov.18/00 to Feb. 17/01) of the Contract the program was continued as it was being planned. After the tests were completed with the fast servo-hydraulic universal machine of LPMM on all four geometries of specimen, that is Standard, U-shape, V-shape and I-shape, an exact analysis of oscillograms was continued. All tests were performed on titanium alloy Ti-6Al-4V, supplied by ARL-Aberdeen, MD. The earlier tests performed on the standard geometry, so-called Modified Double Shear (MDS), was a basis for further numerical calculations of Adiabatic Shear Bands (ASB). Improved constitutive relations had been used in those calculations, and one paper has been submitted in Jan./2001 to International Journal of Impact Engineering.

The LPMM-Metz has developed under previous contracts, partially granted by the European Research Office of the US Army, a unique experimental technique which enables impact shear testing of materials within a wide range of strain rates, the impact range covers strain rates from 10E3 1/s to ~10E5 1/s, [1].

This technique has been applied to perform experiments with three geometries of specimen, that is "U", "V" and "I", with different stress concentrators. After preparation and improvements of experimental setup the experiments are already started and are continued. The main task is to find the role of stress concentrators in Ti-6Al-4V in triggering ASB.

References

[1] J.R.Klepaczko, An Experimental technique for Shear Testing at High and Very High Strain Rates, the Case of a Mild Steel., Int. J. Impact Engng., **15**(1994), 25.

Research reported in this document has been made possible through the support and sponsorship of the US Government through its European Research Office of the US Army. This Interim Report is intended only for the internal management use of the Contractor and the US Government.