Active

Project #: E-18-X91 Cost share #: Rev #: 0
Center # : 10/24-6-R0326-0A0 Center shr #: OCA file #:
Work type : RES
Contract#: AGMT DTD 970211 Mod #: INITIATION Document : AGR
Prime #: Contract entity: GTRC

Subprojects ? : N CFDA: N/A
Main project #: PE #: N/A

Project unit: MSE Unit code: 02.010.112
Project director(s):
MAREK M I MSE (404)894-2380

Sponsor/division names: ELEKTRISOLA, INCORPORATED / BOSCAWEN, NH
Sponsor/division codes: 204 / 062

Award period: 961101 to 970430 (performance) 970430 (reports)

Sponsor amount	New this change	Total to date
Contract value	6,000.00	6,000.00
Funded	6,000.00	6,000.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: PRELIMINARY FEASIBILITY STUDY OF FRICTION REDUCTION IN WIREDRAWING

PROJECT ADMINISTRATION DATA

OCA contact: Michelle A. Starmack 894-4820

Sponsor technical contact	Sponsor issuing office
TIMOTHY J. DAY (603)796-2114	TIMOTHY J. DAY (603)796-2114
ELEKTRISOLA, INC. 126 HIGH ST. BOSCAWEN, NH 03303	ELEKTRISOLA, INC 126 HIGH STREET BOSCAWEN, NH 03303 EXT. 332 FAX (603) 796-2111

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : N/A N/A supplemental sheet
Equipment title vests with: Sponsor X GIT
NO EQUIPMENT PROPOSED
Administrative comments -
INTIATION OF COST REIMBURSEMENT RESEARCH PROJECT AGREEMENT.

PROJECT CLOSEOUT - NOTICE

Closeout Notice Date 09-MAY-1997

Project Number E-18-X91 Doch Id 47165

Center Number 10/24-6-R0326-0A0

Project Director ,

Project Unit MSE

Sponsor ELEKTRISOLA, INCORPORATED/BOSCAWEN, NH

Division Id 12430

Contract Number AGMT DTD 970211 Contract Entity GTRC

Prime Contract Number

Title PRELIMINARY FEASIBILITY STUDY OF FRICTION REDUCTION IN WIREDRAWING

Effective Completion Date 30-JAN-1997 (Performance) (Reports)

Closeout Action:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	
Final Report of Inventions and/or Subcontracts	N	
Government Property Inventory and Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

Comments

Distribution Required:

Project Director/Principal Investigator	Y
Research Administrative Network	Y
Accounting	Y
Research Security Department	N
Reports Coordinator	Y
Research Property Team	Y
Supply Services Department	Y
Georgia Tech Research Corporation	Y
Project File	Y

E-18-X91
#1

Final Report

PRELIMINARY FEASIBILITY STUDY OF FRICTION REDUCTION IN WIREDRAWING

By:
Miroslav Marek, Ph.D.
School of Materials Science and Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0245

Under:
Contract # AGMT DTD 970211
Elektrisola, Inc
126 High Street
Boscawen, NH 03303

Period of Performance:
03/01/97 - 04/30/97

May 1, 1997

Table of Contents

$$\mu = f/N$$

where N is the normal force and f is the shear force. Since the normal force is constant (dead weight) during the test the shear force, measured by the loadcell, is linearly proportional to the coefficient of friction. A higher output signal from the loadcell corresponds to higher friction. The results are reported in the form of the signal of the loadcell vs. applied voltage, which provides relative values of frictional force vs. voltage.

4. TEST RESULTS

4.1 Preliminary tests

In the preliminary tests friction between tungsten carbide and rotating copper was measured in emulsion lubricants prepared from oils WD7F and SyUSA. Although the applied voltage had an effect on friction, the results were inconsistent. Examination has shown an apparent degradation of tungsten carbide as a cause of the inconsistency of the behavior. An attempt was made to use a diamond from one of the wiredrawing dies provided by Elektrisola, Inc, but the piece was too small to be useable in the laboratory setup available. Instead, a glass rod (Pyrex glass) about 3/8" in diameter was cut to a length of about 3/8", one flat face was polished, and the polished face of the cylinder was pressed against the rotating copper cylinder in the setup shown in Fig. 1.

4.2 Tests of friction between glass and copper

The tests were performed at a temperature of 40°C to approximate the condition in wiredrawing. Applied DC voltage was varied between 0 and 35 V in 5 V increments; copper was the positive electrode in the cell. The output of the load cell was digitally recorded using a microcomputer and Labtech Notebook data acquisition software. The output signal data at each voltage setting were averaged for about 10 s.

Tests were performed using the emulsion lubricants provided by Elektrisola, Inc. In addition, one series of tests was performed using the Sy-USA oil emulsion at a concentration of 10%.

The results of the friction tests using the Elektrisola, Inc. emulsions are shown in Fig. 2 as a plot of the load cell output (proportional to the friction force) vs. the applied DC voltage. For a fresh WD7F lubricant there was only a small drop in friction with applied voltage. The used lubricant, on the other hand, (a) generated higher friction than the fresh one; (b) the frictional force could be lowered by an application of voltage to at least the one shown by the fresh lubricant. The decrease in friction for the aged lubricant was about 35% at 5 V applied voltage and more at higher voltages.

Tests with the Sy-USA lubricant showed somewhat lower friction than with fresh WD7F and there was a decrease of about 30% with the application of voltage, but little further friction reduction when the voltage was increased. Results of tests using a higher oil concentration (10%) are shown in the Fig. 3 in comparison with those for the emulsion lubricant provided by Elektrisola, Inc. At the higher concentration friction was reduced more substantially by using higher voltages, to 50% or even more. It must be noted, however, that the use of high voltages may have a detrimental effect on the surface quality of copper.

5. CONCLUSIONS

5.1 Application of a DC voltage between copper and an auxiliary electrode reduces friction between rotating copper and glass in an aged WD7F emulsion lubricant and a fresh Sy-USA lubricant.

5.2 The effect of the applied voltage for the Sy-USA lubricant increases at higher oil concentrations.

6. SIGNATURES

Prepared by:

Miroslav Marek, Ph.D., Professor
Georgia Institute of Technology

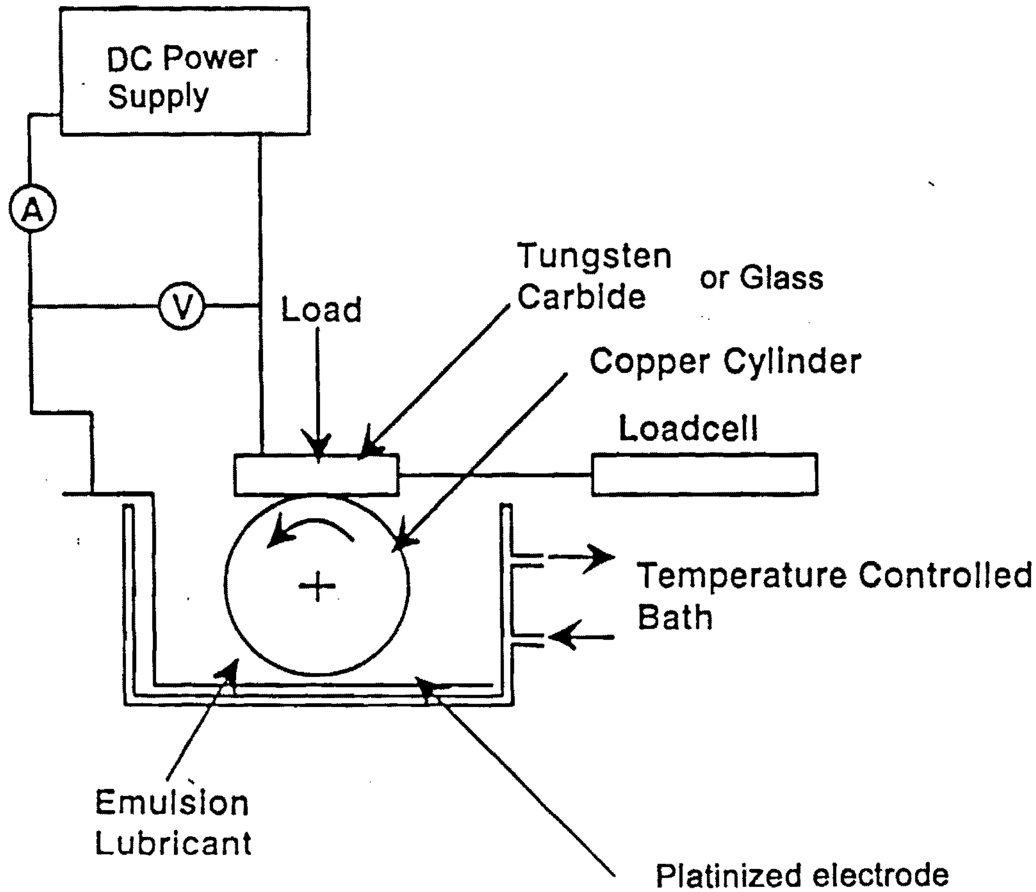

FIG. 1: Laboratory setup for friction measurements

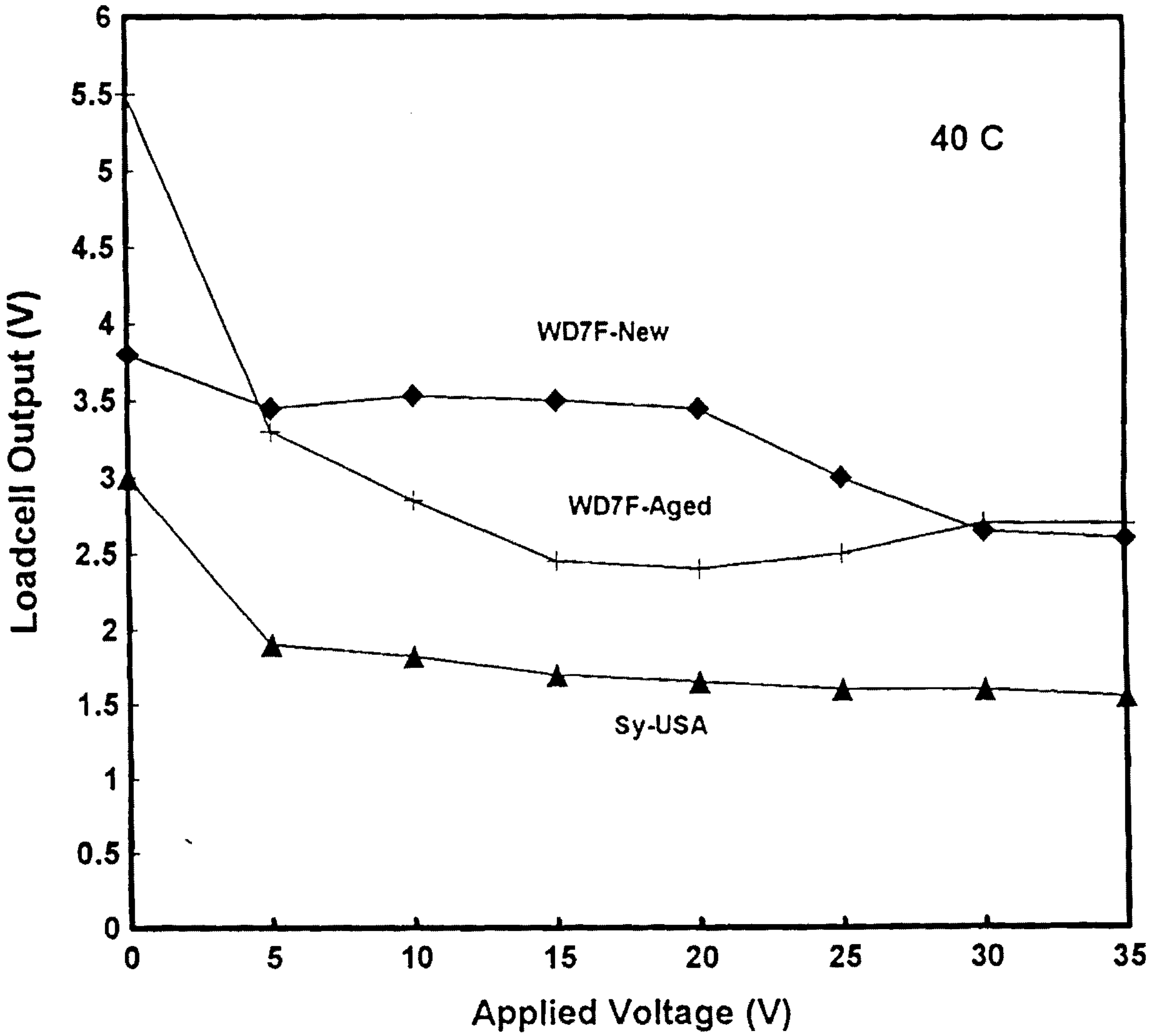

FIG. 2: Test results for glass/copper friction vs. applied DC voltage for emulsion lubricants provided by Elektrisola, Inc.

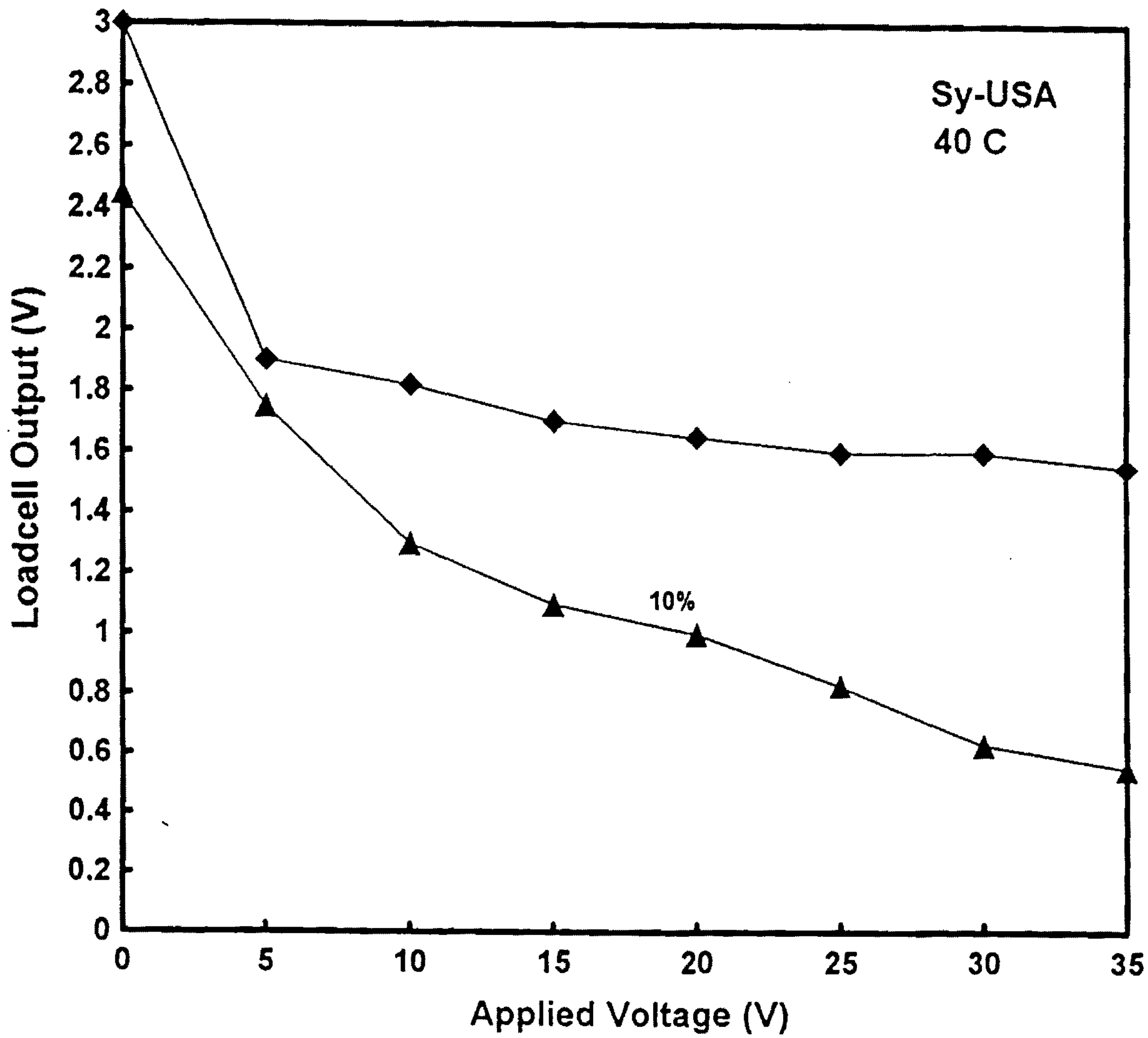

Fig. 3: Test results for glass/copper friction vs. applied DC voltage for Sy-USA emulsion lubricant at 10% oil concentration and as provided by Elektrisola, Inc.