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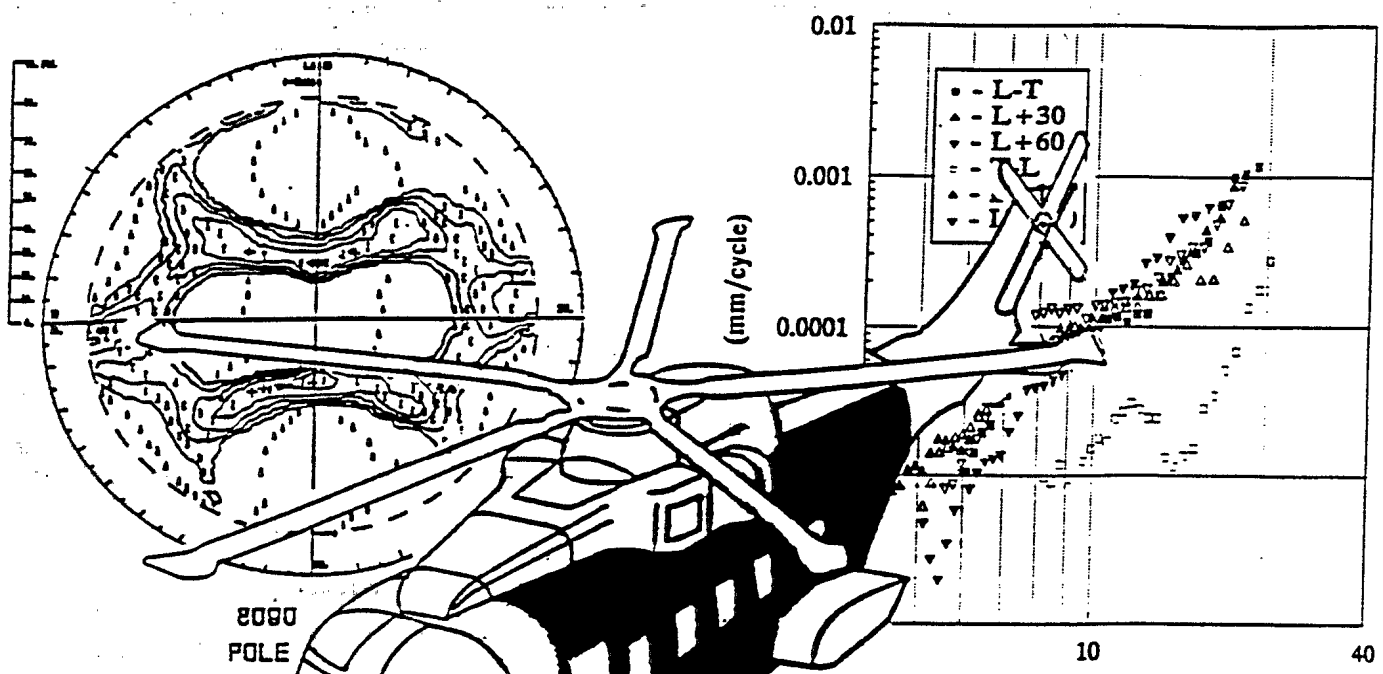
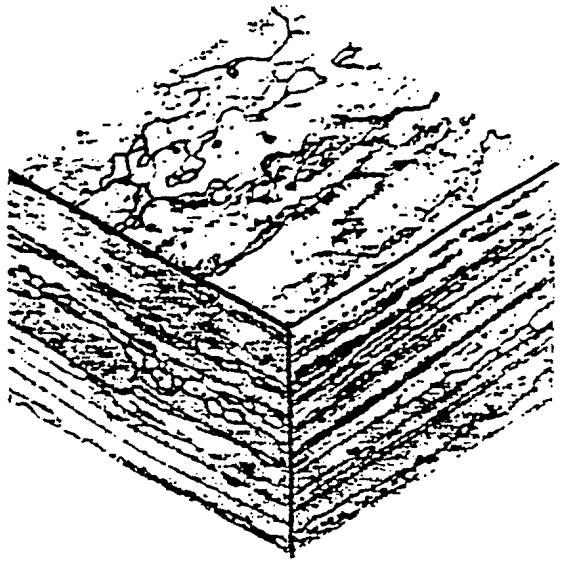
WORKSHOP PROCEEDINGS

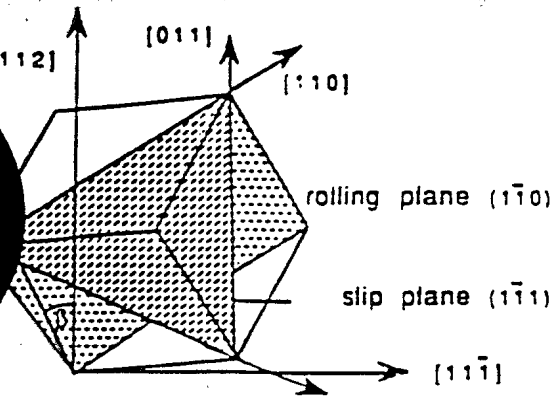
RESEARCH AND DEVELOPMENT ON ALUMINUM-LITHIUM ALLOYS

6-7 APRIL 1993



$$\gamma_f - \gamma_r = \ln\left[\left(\frac{2f}{2f\alpha_r \Delta K\cos^2\phi}\right)^{V_r H} \exp\left(-\frac{\Delta G_r^a + V_r \tau_{or}}{V_r H}\right)\right]$$





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DREP REPORT 93-1

PROCEEDINGS OF A WORKSHOP ON "RESEARCH AND DEVELOPMENT ON ALUMINUM-LITHIUM ALLOYS"

Defence Research Establishment Pacific
Forces Mail Office
Victoria, BC, Canada
V0S 1B0

6-7 April 1993

Prepared by J. Morrison

November 1993

DREP Report 93-1

PROCEEDINGS OF THE WORKSHOP ON "RESEARCH AND DEVELOPMENT ON ALUMINUM-LITHIUM ALLOYS"

Abstract

The high stiffness and low density of lithium-containing aluminum alloys makes them prime candidates for a number of commercial and defence aircraft applications. It is well recognized that the strong crystallographic texture developed during the processing of these alloys, and the complex precipitation resulting from their heat treatment yields a material with some unusual properties. For several years Canadian government laboratories have had programs on aluminum-lithium alloysdealing with both long term research and development to characterize these materials, and the quality assurance issues and life cycle management implications arising from their exploitation in defence systems. This workshop was intended to provide a review of the activities undertaken to date, and to foster an increasing coordination of the overall effort to maximize the technical support provided to the Canadian Forces.

Résumé

La haute rigidité et la densité faible d'alliages d'aluminium contenant du lithium les apprêtent aux applications pour des aéronefs commerciaux et de défense. La forte texture cristallographique qui se produit au cours du traitement de ces alliages ainsi que la précipitation complexe résultant du traitement thermique de ceux-ci produit un matériau aux propriétés peu communes. Depuis quelques années les laboratoires du gouvernement canadien ont des programmes qui portent sur les alliages aluminium-lithium : la recherche à long terme aussi bien que le développement pour caractériser ces matériaux, ainsi que les questions d'assurance de qualité et les implications de gestion de cycle de vie provenant de l'exploitation de ces matériaux dans les systèmes de défense. Le but de cet atelier fut de résumer les activités initiées à date et d'encourager la coordination croissante de l'effort global de maximiser les soutiens techniques fournis aux Forces canadiennes.

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PROCEEDINGS OF THE WORKSHOP ON "RESEARCH AND DEVELOPMENT ON ALUMINUM-LITHIUM ALLOYS"

Defence Research Establishment Pacific

Victoria, BC, April 1993

INTRODUCTION

The high stiffness and low density of lithium-containing aluminum alloys makes them prime candidates for a number of commercial and defence aircraft applications. It is well recognized that the strong crystallographic texture developed during the processing of these alloys, and the complex precipitation resulting from their heat treatment yields a material with some unusual properties. There has been increasing commercial interest in these materials over the past decade, and for several years laboratories within the Canadian Department of National Defence, notably the Defence Research Establishment Pacific (DREP) and the Quality Engineering Test Establishment (QETE), and also the National Research Council's Institute for Aerospace Research (IAR), have had programs on aluminum-lithium alloys. This work has included both long term research and development to characterize these materials as they become commercially available, and has also addressed the quality assurance issues and life cycle management implications arising from their potential exploitation in defence systems. Although these efforts involved some loose coordination and an awareness of each others objectives and technical activities, and the exchange of materials as they became available, there was no attempt at this stage to formalize the overall program. DREP and, to a certain extent, IAR were engaged in an extensive international collaborative effort under the Technical Cooperation Program (TTCP), while QETE was responding to NDHQ procurement and life cycle management concerns.

Prior to its recent cancellation, Canada's intention to purchase the EH101 helicopter under the New Shipborne Aircraft and New Search and Rescue Helicopter projects also added considerable impetus to aluminum-lithium studies within the Department of National Defence. The development of this helicopter featured the most extensive application seen to date of these new light alloys. DREP, QETE, and IAR agreed to sponsor a workshop to provide a review of the activities undertaken to date, and to foster an increasing coordination of the overall effort to maximize the technical support provided to the Canadian Forces. In addition to the inputs from the government laboratories, and their contractors, the workshop included a keynote seesion on both the development of aluminum-lithium alloys, and also on the EH101 project. The scope of the workshop was also broadened to include inputs from interested Canadian universites, and also from foreign laboratories involved in the international collaboratiive programs.

The two day workshop was held at DREP in April 1993, and a total of 16 papers were presented. The invited audience of about 35 included DND personnel from government laboratories and agencies, DND contractors, plus interested industrial engineers and university researchers. This proceedings includes the contributions from all sixteen presentations. In addition to the Keynote presentations, the program included two sessions on mechanical properties, fatigue, and fracture, and one session on corrosion. It is intended that this proceedings will provide a useful basis for the assessment of the future research and development needs of the Canadian Forces in aluminum-lithium alloy technology.

LIST OF ATTENDEES

Name	Representing
A.M. Abdel-Latif	QETE
S.D. Antolovich	University of Washington
Major P. Ayotte	PMO NSA/NSA
Major P. Beaudet	DGAEM/DAS Eng 6
M. Bernard	Ecole Polytechnique
Captain T.I. Bocz	AMDU/MPO 4
M. Bright	QETE
Captain M. Castonguay	DGAEM/DAS Eng 6
N.G. Cerullo	DGAEM/DAS Eng 3
M. Chadwick	DREP
T. Croft	Pyrotek Inc.
S. Cowley	Canadian Aircraft Products
M. Ferahi	University of Toronto
Captain J.S. Ferguson	DREP
R. Grimes	Alcan International Ltd.
D.A. Hull	Engineering Material Research
G.R. Labbé	DGMEM/DSE
Captain D. Lamanque	PMO NSA/NSH
Captain K. Lemke	Georgia Tech.
D. Lenard	DREP
W.L. MacMillan	CRAD/DRDA
B. Martin	Canadian Aircraft Products
S.A. Meguid	University of Toronto
J. Morrison	DREP
M. Paré	AMDU/MPO 4
B.F. Peters	DREP
J. W. Provan	University of Victoria
D. Raizenne	NRC/IAR
P.R. Roberge	RMC
M. Roth	QETE
A. Smith	Westlend Helicopters Ltd.
M. Squibb	DRA (Farnborough)
R. Thompson	CRAD/DRDA
W. Wallace	NRC/TIAR
W. Williams	Canadian Aircraft Products
X. Wu	NRC/IAR
M. Yanishevsky	QETE
Z. Zhai	DREP

ACKNOWLEDGEMENTS

The assistance of Martin Roth of the Quality Engineering Test Establishment and Don Raizenne of the NRC Institute for Aerospace Research in developing this workshop is gratefully acknowledged. Paul Martin of the Defence Research Establishment provided extensive support in arranging DREP facilities and CFB Esquimalt support.

SESSION A

KEYNOTE PRESENTATIONS