

REPORT DOCUMENTATION PAGE

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Standard Form 298 (Rev. 8-98)
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36 separate files are enclosed

1122 038

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (TI) (STINFO)

10 Aug 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2000-163**
Liu, C.T., "Strain Rate Effect on Crack Opening and Growth in a Particulate Composite Material at Low Temperature"

3rd Conference on Mechanics of Time Dependent Materials (Statement A)
(Erlangen, Germany, 18-20 Sep 00) (Submission Deadline: 28 Aug 00)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: _____

Signature _____ Date _____

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review

Comments: _____

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3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b.) appropriateness of distribution statement, c.) military/national critical technology, d.) economic sensitivity, e.) parallel review completed if required, and f.) format and completion of meeting clearance form if required

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4. This request has been reviewed by PRS for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: _____

APPROVED/APPROVED AS AMENDED/DISAPPROVED

PHILIP A. KESSEL Date
Technical Advisor
Propulsion Science and Advanced Concepts Division



Strain Rate Effect on Crack Opening and Growth in a Particulate Composite Material at Low Temperature

C.T. Liu

Propulsion Directorate

Air Force Research Laboratory

AFRL/PRSM

10 E. Saturn Blvd.

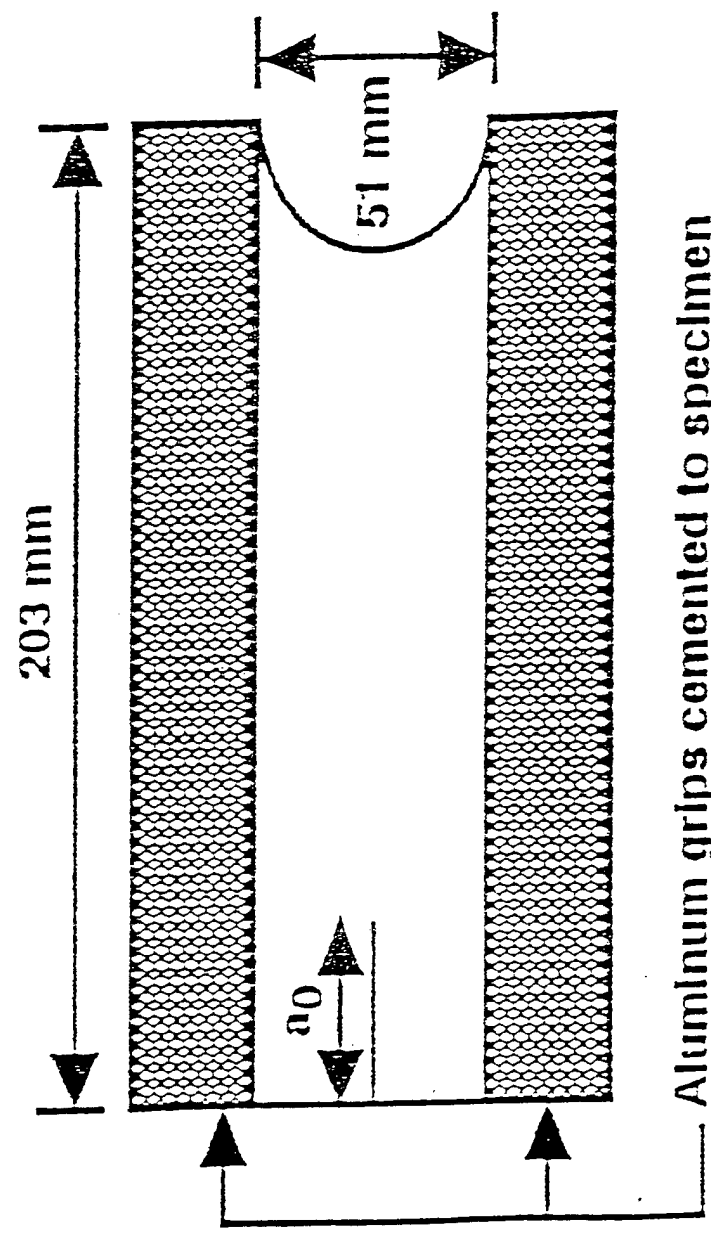
Edwards AFB, CA 93524-7680

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Objective

- Investigate the Effects of specimen thickness (2.54 mm and 12.7 mm) and Displacement Rate (2.54 mm/min and 12.7 mm/min) on Crack Opening Displacement, Failure process Zone, Local Strain Fields, and Crack Growth Behavior at Low Temperature.



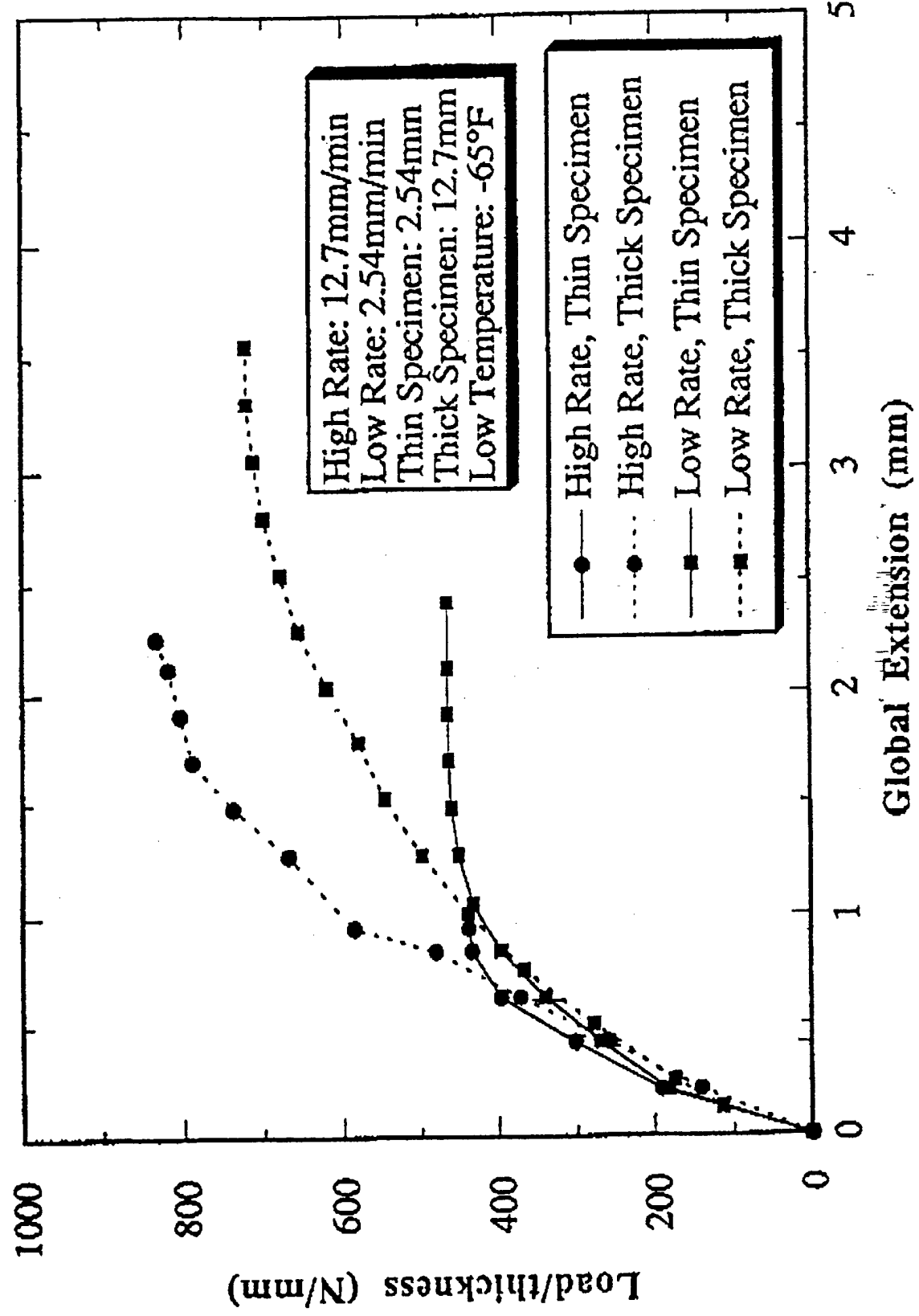
Aluminum grips cemented to specimen
Specimen thickness: 2.5 mm

$a_0 = 23\text{mm}$

Specimen Geometry

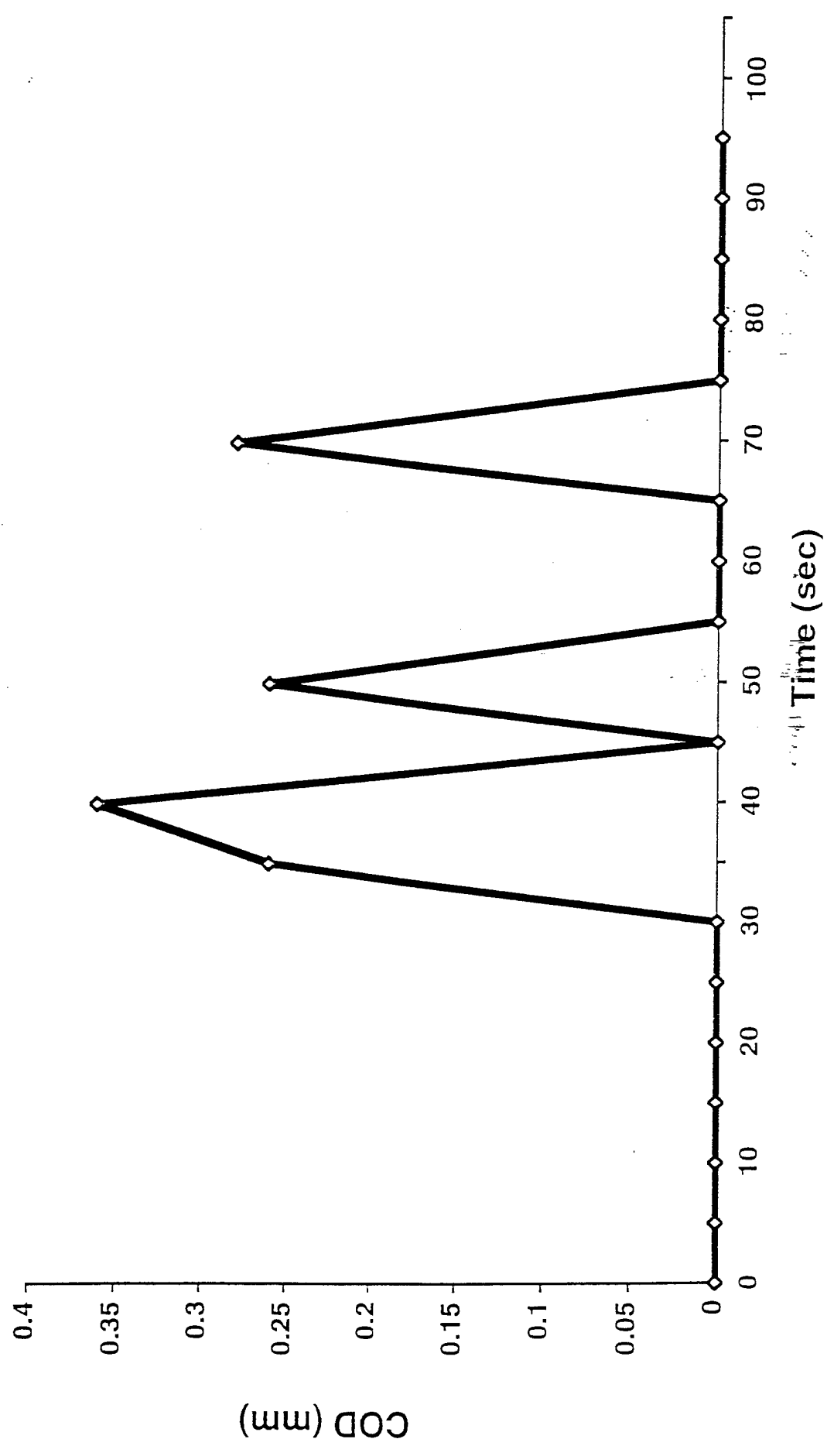


Load / Thickness vs. Global Extension



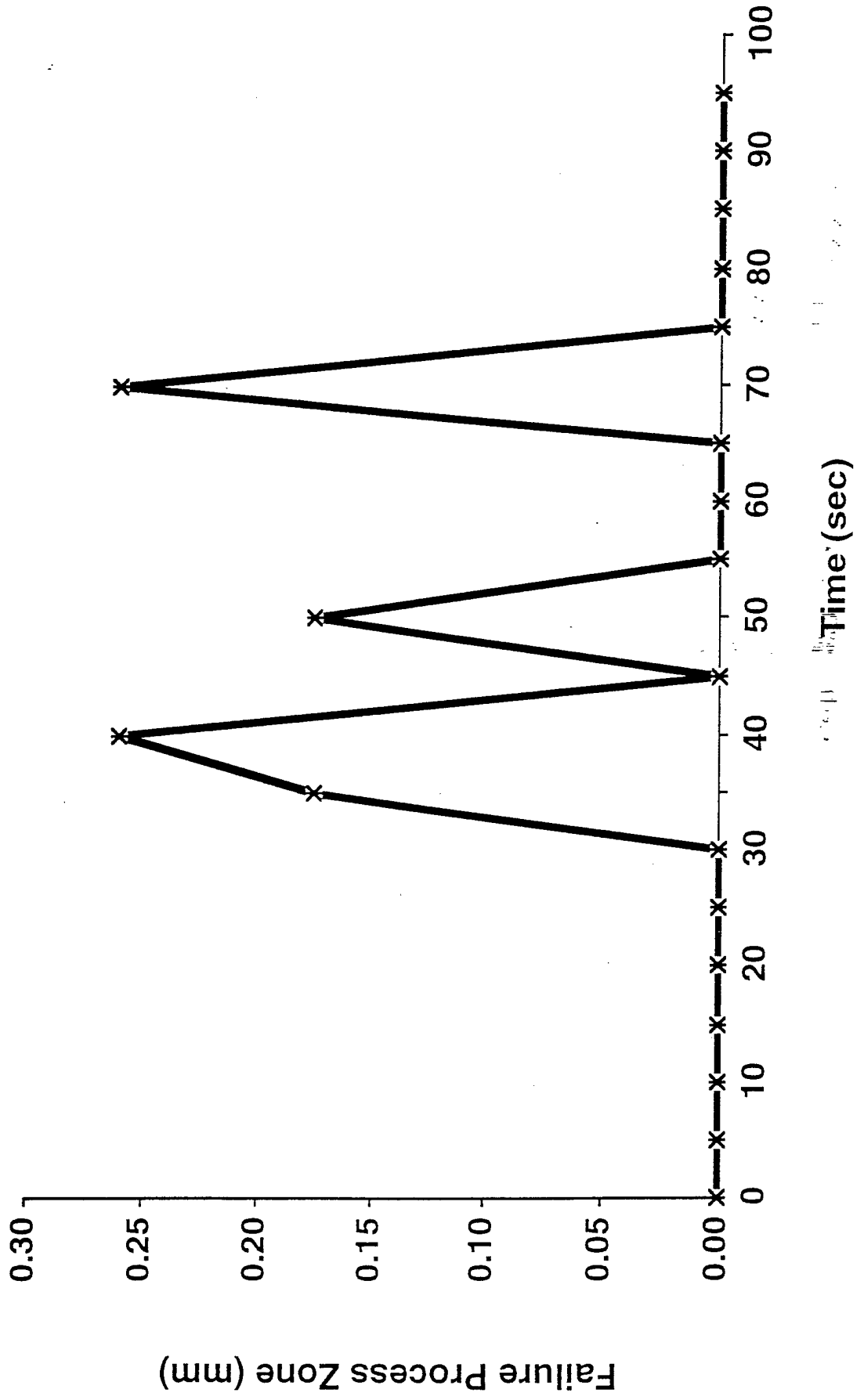


TKLRLT - COD vs. Time



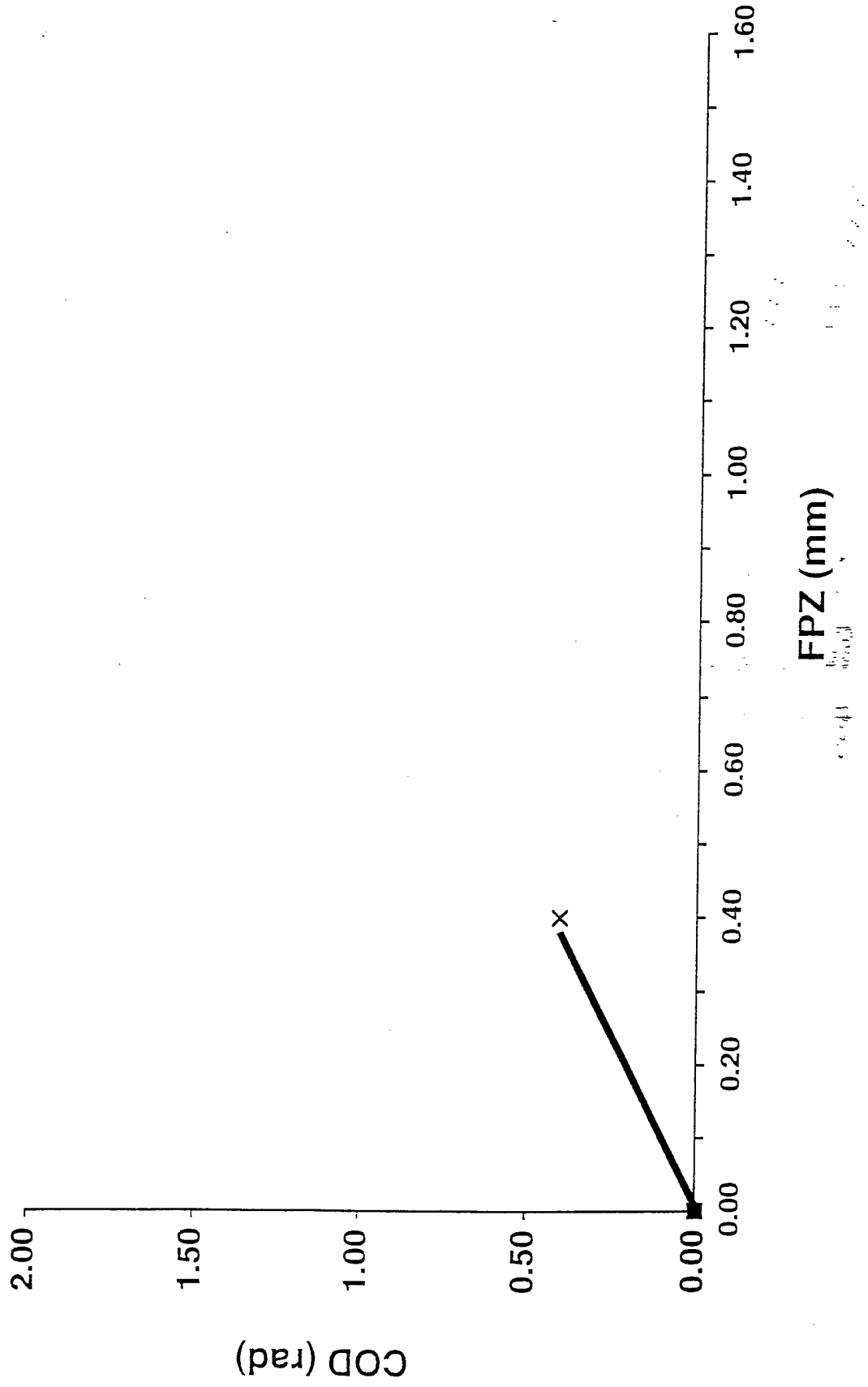


TKLRLT - Failure Process Zone vs. Time



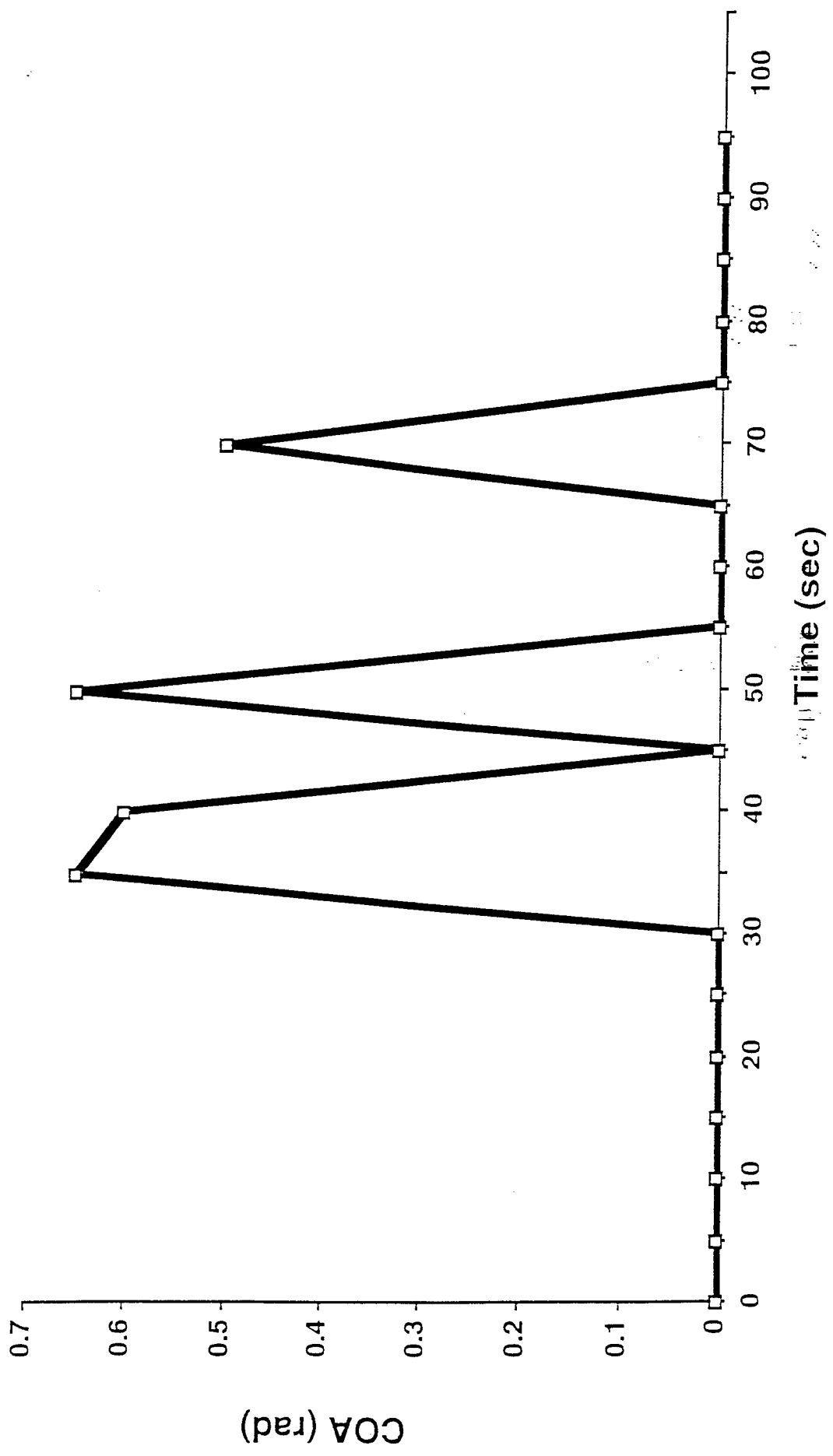


TKLRLT - COD vs. FPZ



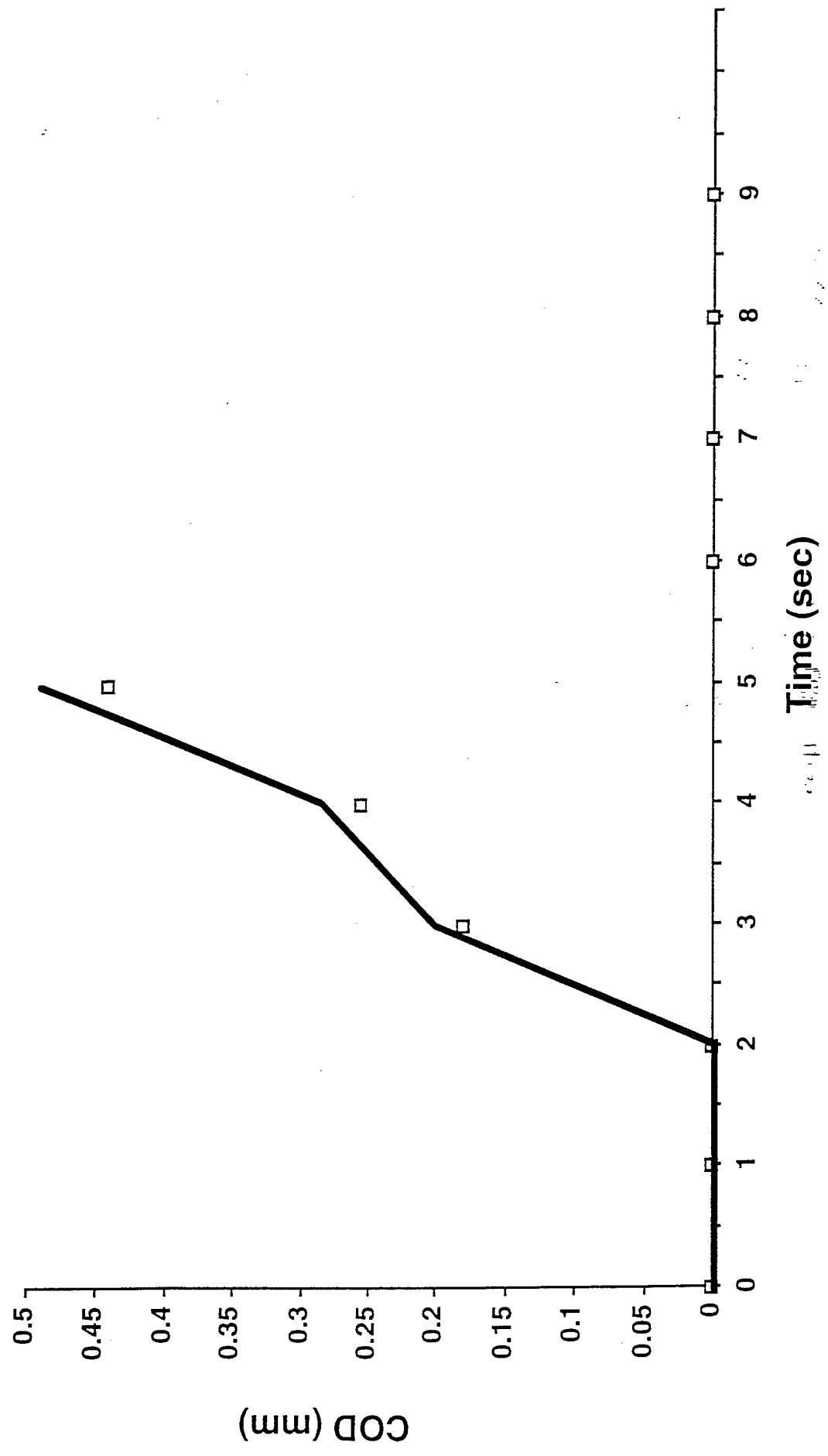


TKLRLT - COA vs. Time



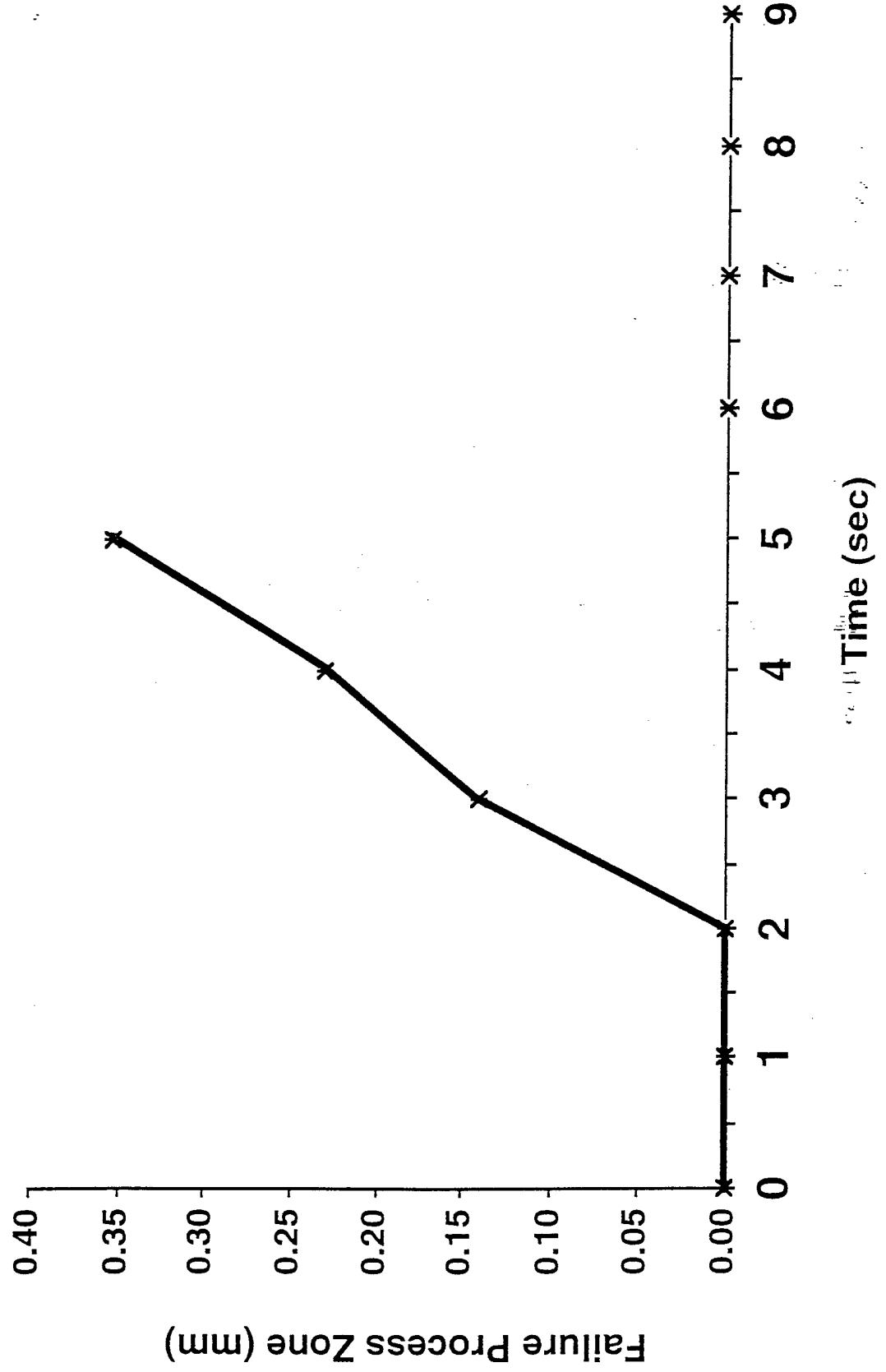


TKHRLT - COD vs. Time



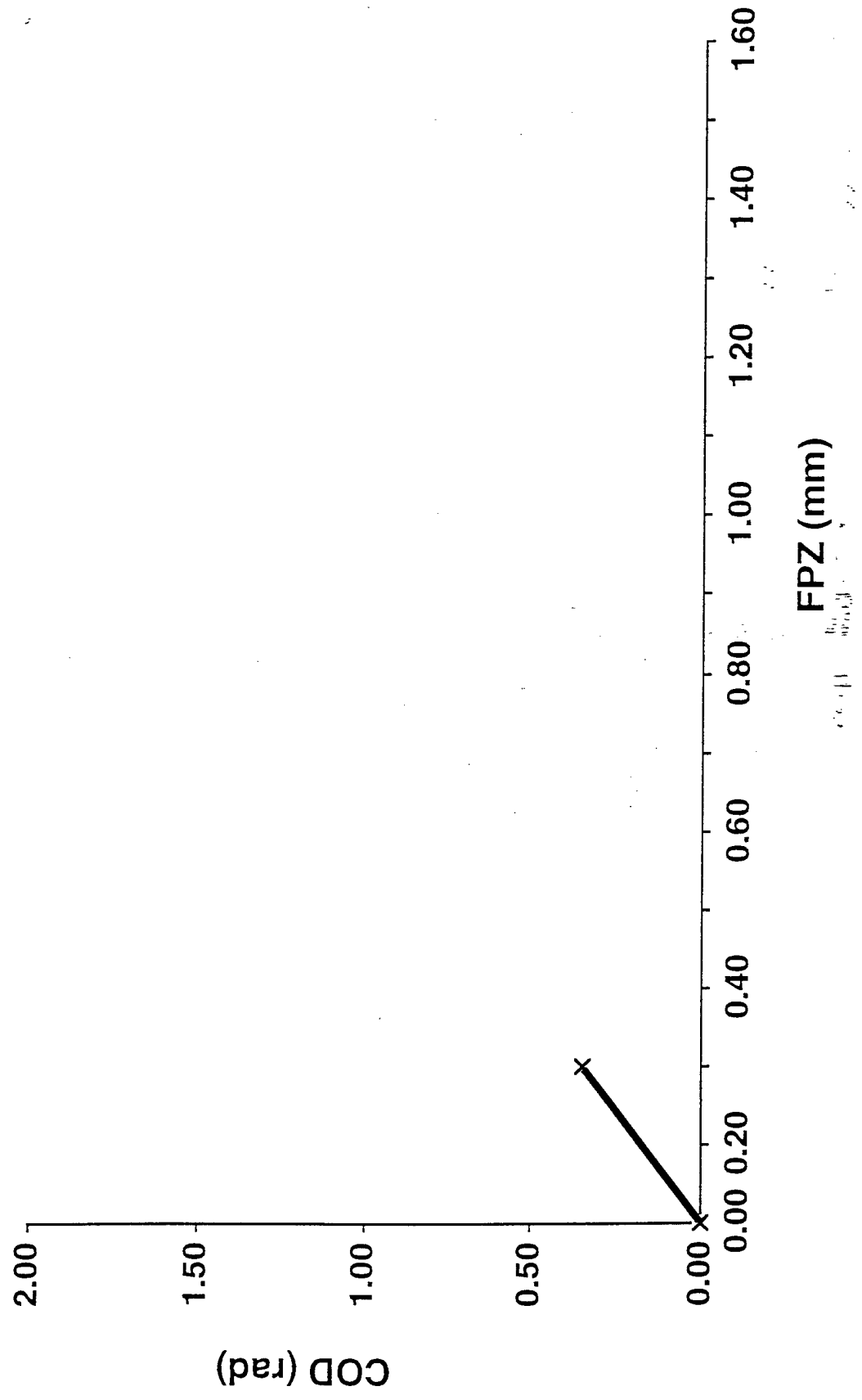


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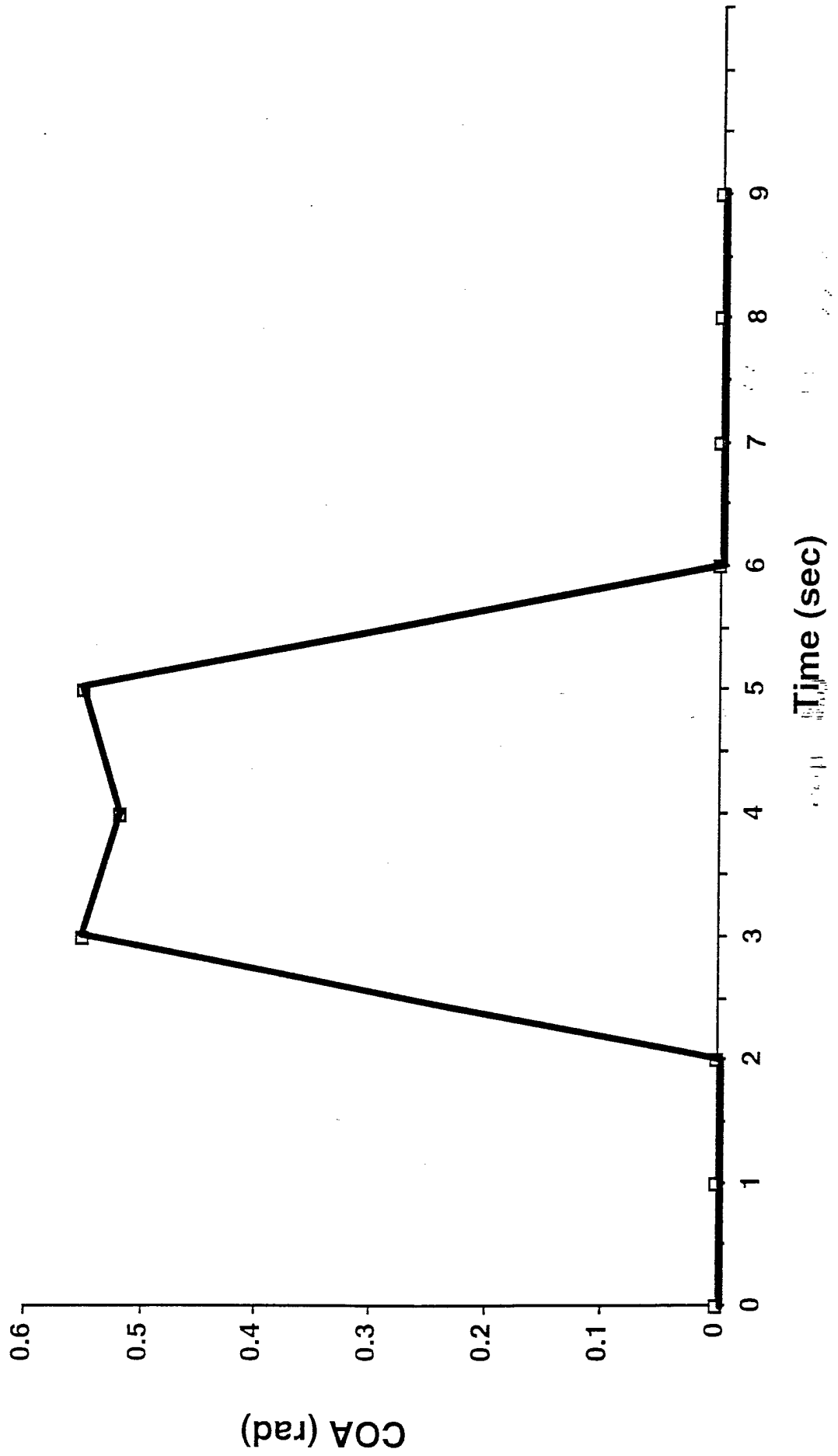


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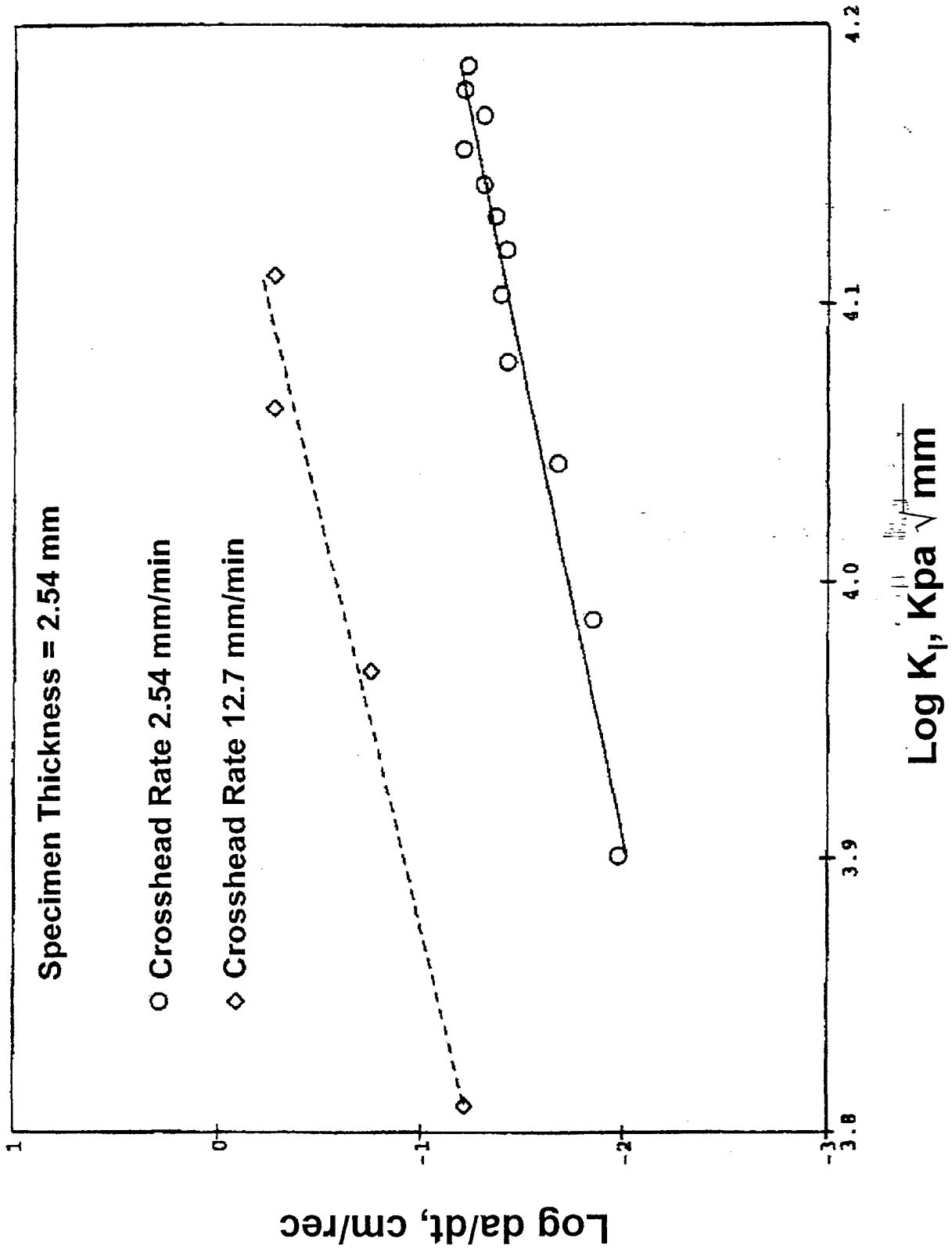


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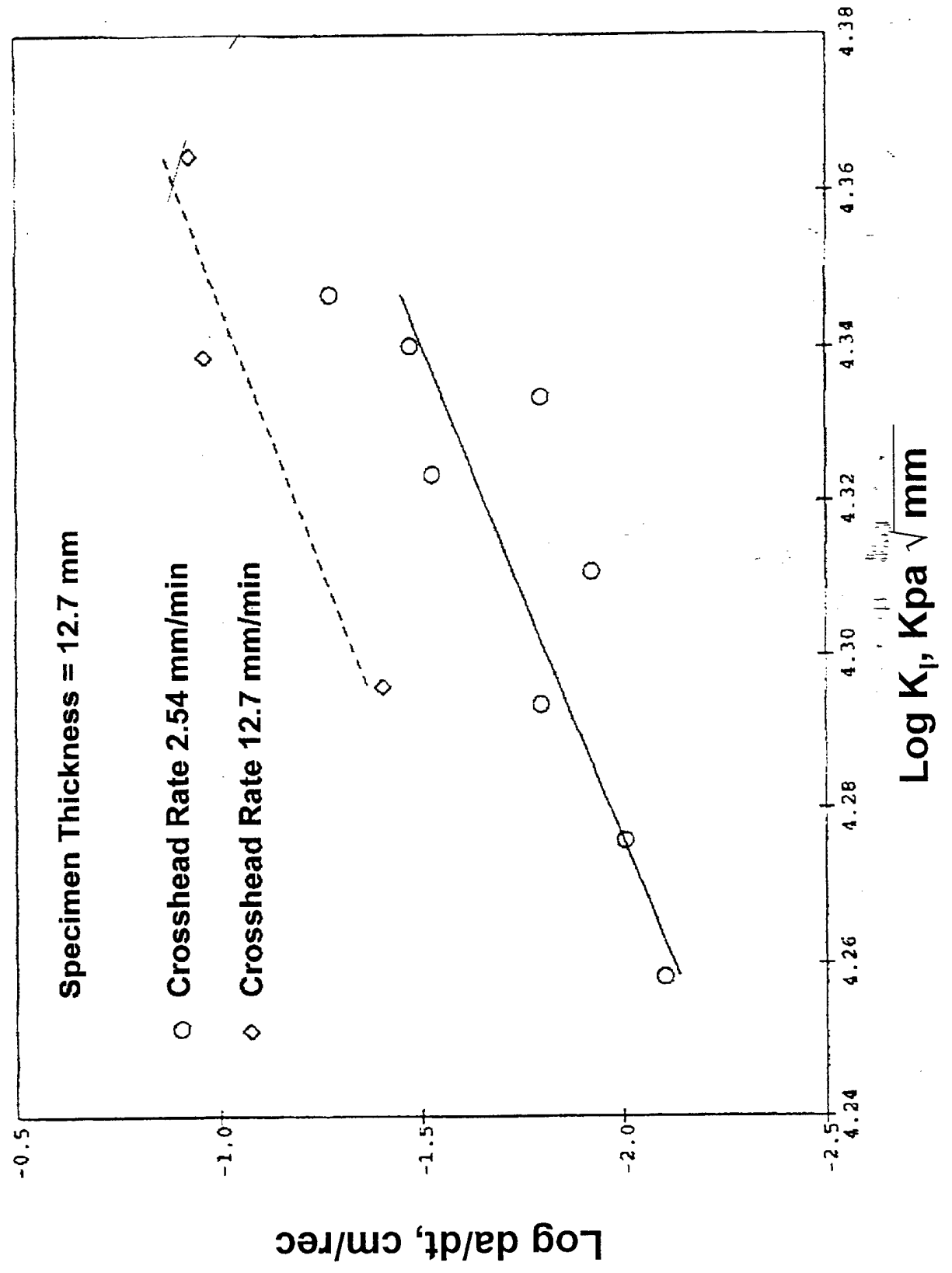


Crack Growth Rate vs. Mode I Stress Intensity Factor

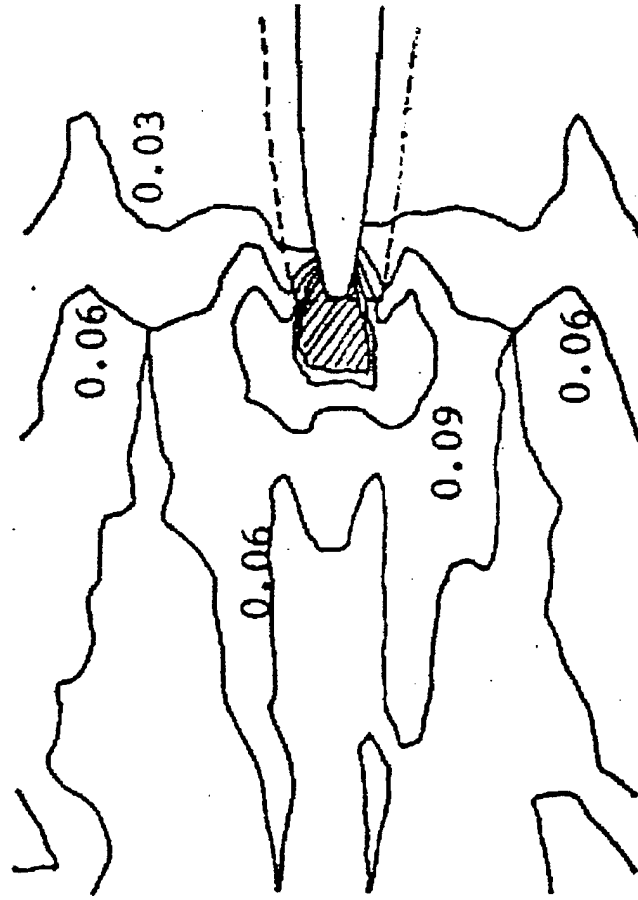




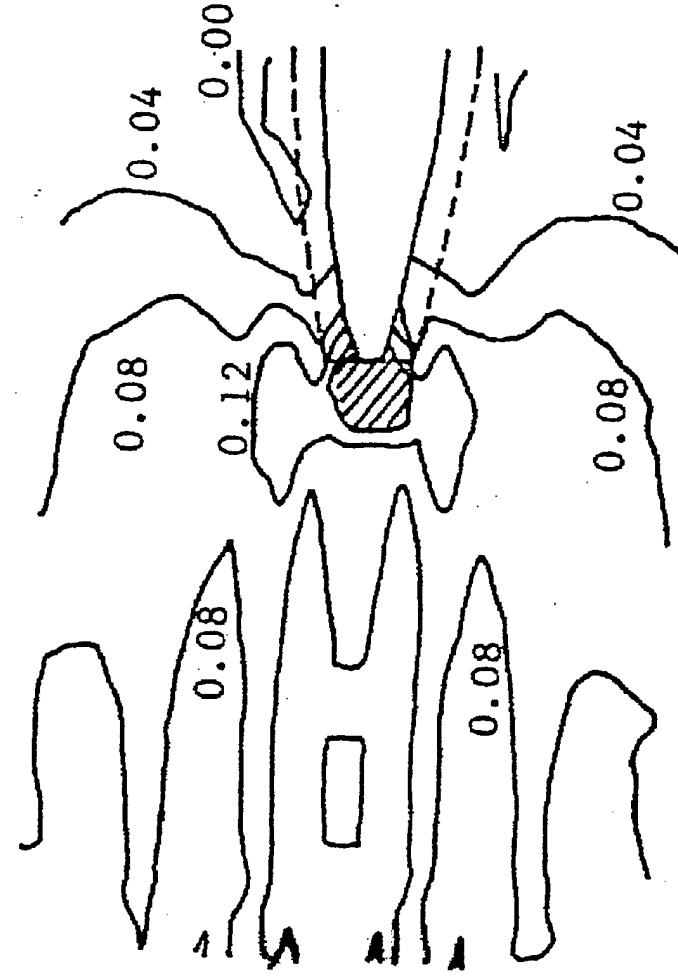
Crack Growth Rate vs. Mode I Stress Intensity Factor



Iso - Intensity Strain Contours (thickness = 0.1 in.)



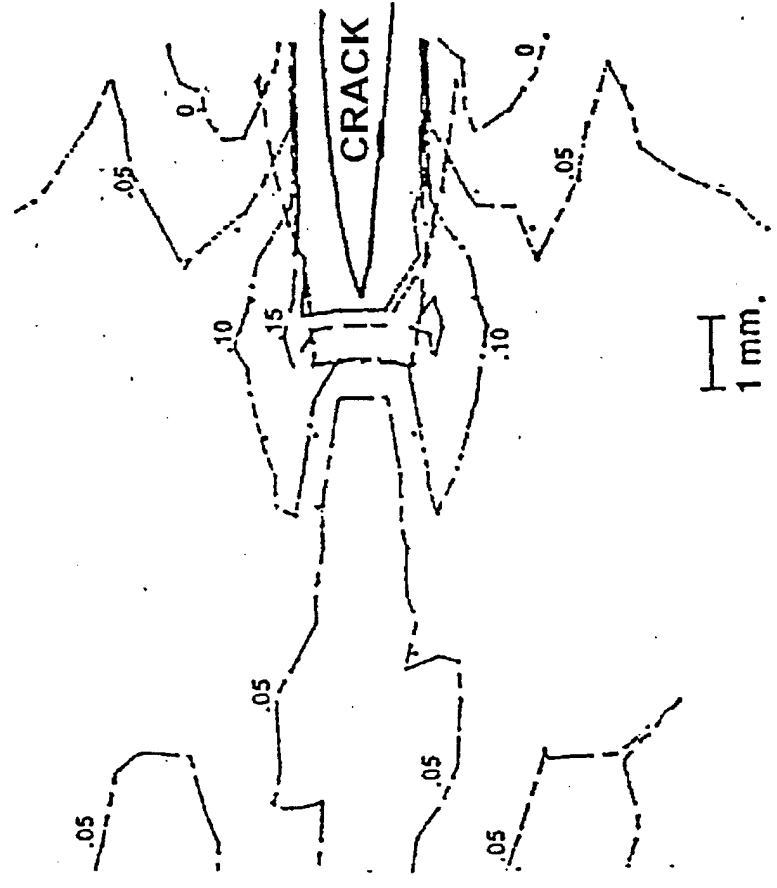
Crosshead Rate = 12.7 mm/min
Global Strain = 0.83%



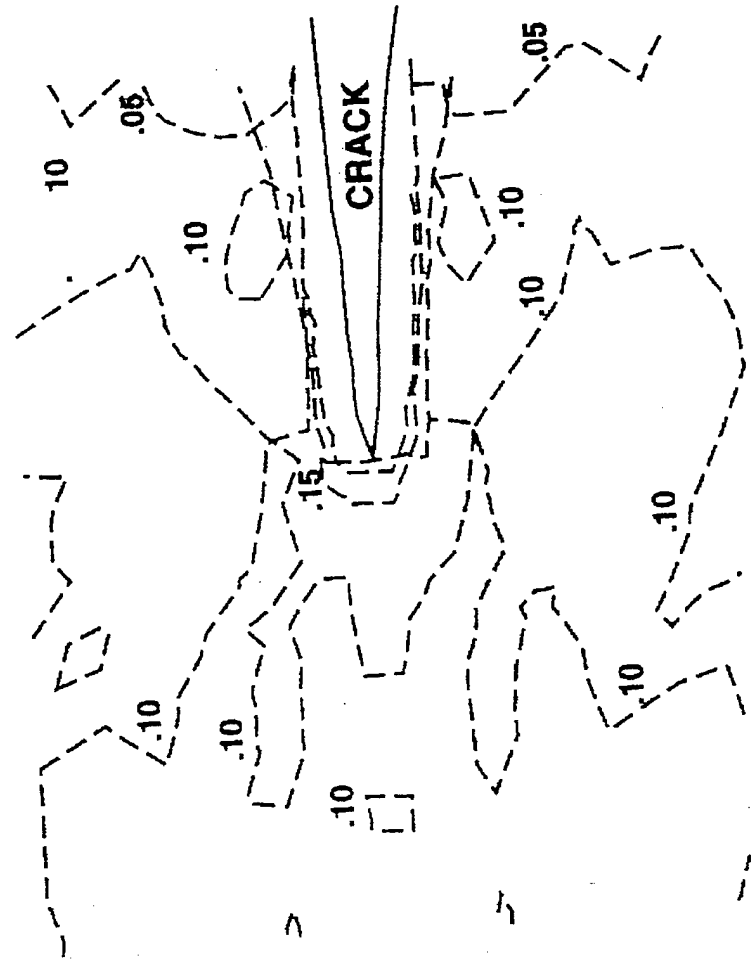
Crosshead Rate = 2.54 mm/min
Global Strain = 0.83%



Iso - Intensity Strain Contours (thickness = 0.5 in.)



Crosshead Rate = 2.54 mm/min
Global Strain = 3.3%



Crosshead Rate = 12.7 mm/min
Global Strain = 3.3%



Conclusions

- For the thin specimen and the thick specimen tested at 2.54 mm/min, the basic crack growth behavior consists of a blunt – growth – blunt phenomenon.
- For the thick specimen tested at 12.7 mm/min displacement rate, a classical brittle fracture occurs.
- The increase in displacement rate alters the local strain fields but the iso-strain contours are of the same general form.
- A power law relationship exists between the Mode I stress intensity factor and the crack growth rate.