

# REPORT DOCUMENTATION PAGE

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5b. GRANT NUMBER  
5c. PROGRAM ELEMENT NUMBER

*Please see attached*

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AFRL/PRS  
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Edwards AFB CA 93524-7048

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5 Pollux Drive  
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Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

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15. SUBJECT TERMS

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MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

29 May 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2001-124**  
Liu, C.T., "Investigating Cumulative Damage in a Highly Filled Polymeric Material (VuGraphs)"

**2001 ASME Summer Meeting**  
**(San Diego, CA, 27-29 June 01) (Deadline: 21 June 01)**

**(Statement A)**

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.

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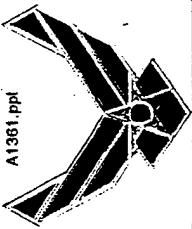
\_\_\_\_\_  
PHILIP A. KESSEL Date  
Technical Advisor  
Space and Missile Propulsion Division

# Investigating Cumulative Damage in a Highly Filled Polymeric Material



C. T. Liu  
AFRL/PRSM

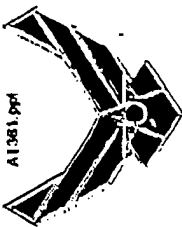
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# Objectives

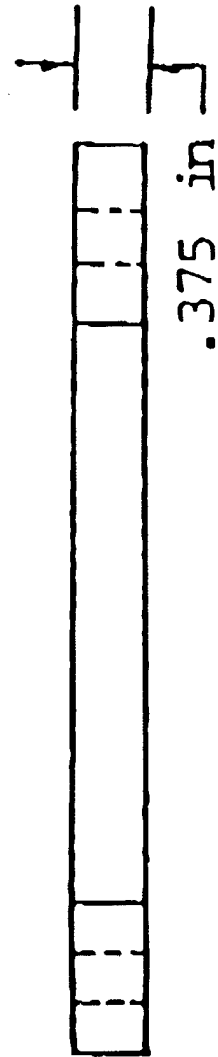
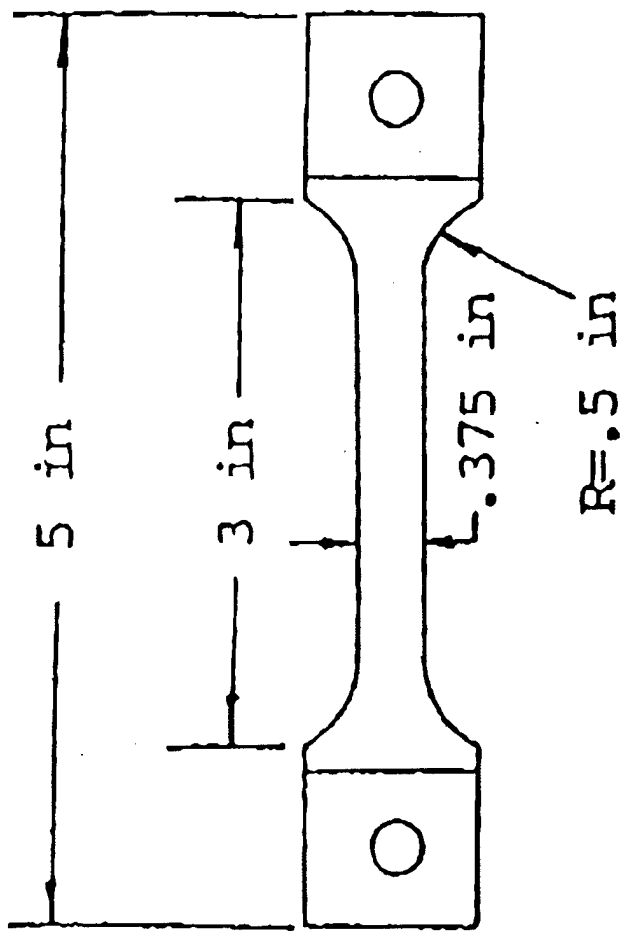
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- Investigate the Effects of Strain Rate and Cyclic Loading on Cumulative Damage in a Highly Filled Polymeric Material.
- Determine the Relationship between the NDE Damage Parameter and material Properties.



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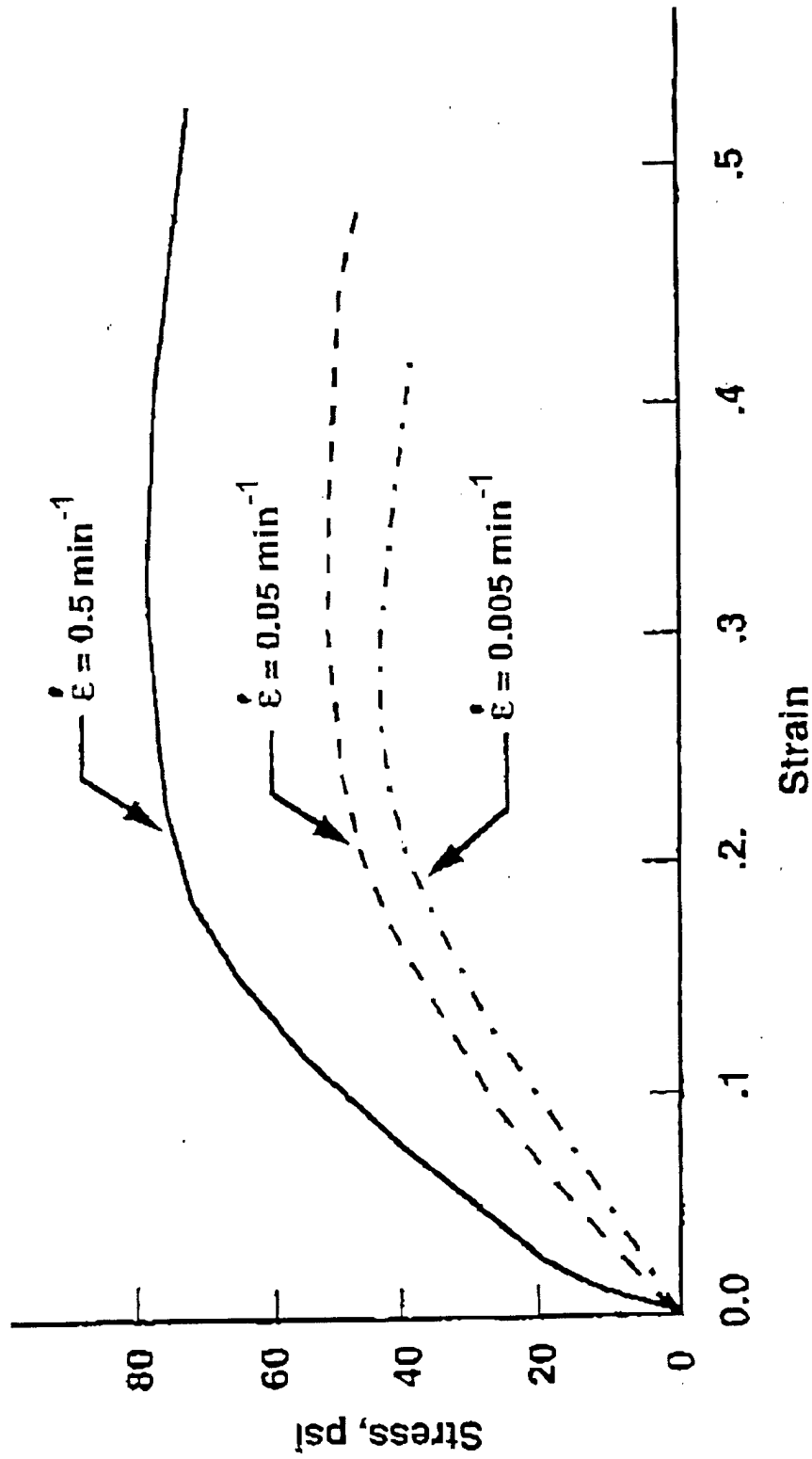
# Specimen Geometry





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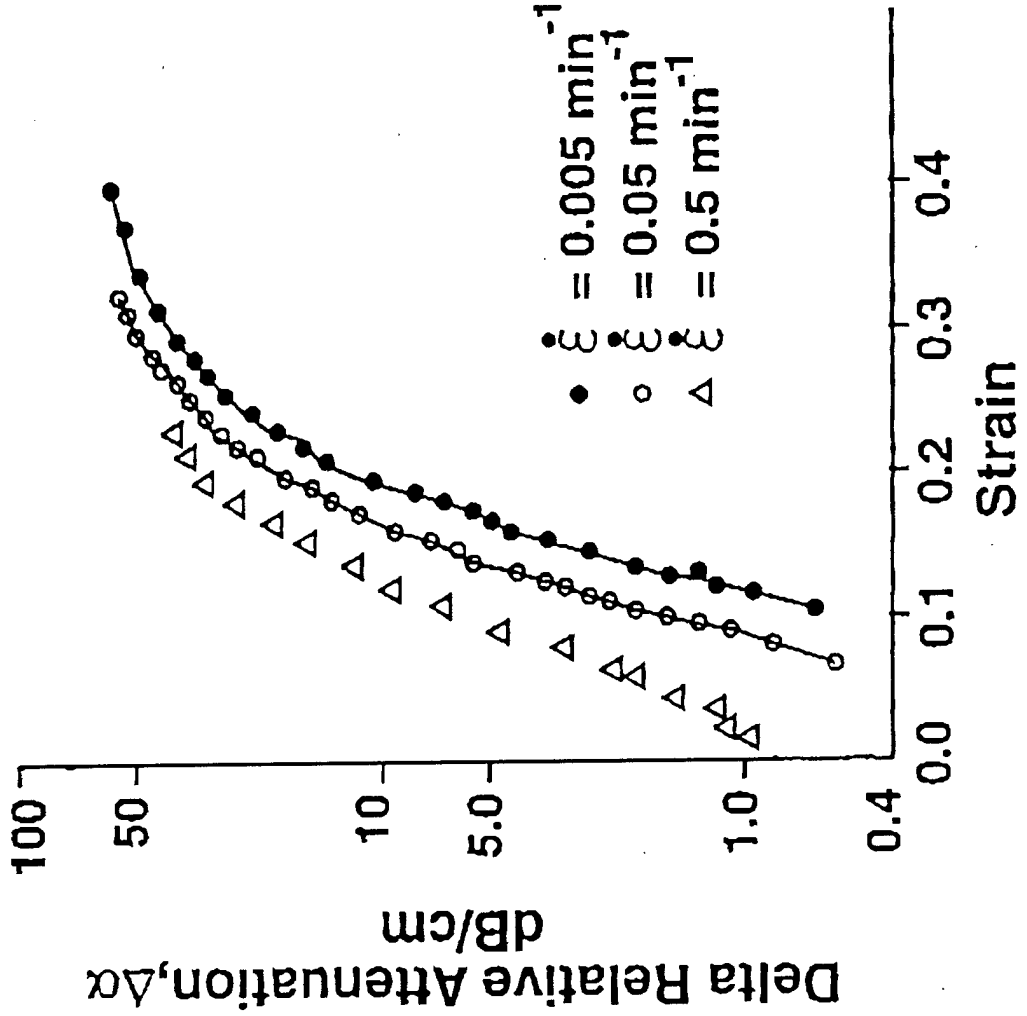
# Stress-Strain Curves as Functions of Strain Rate

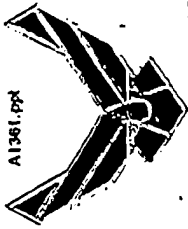




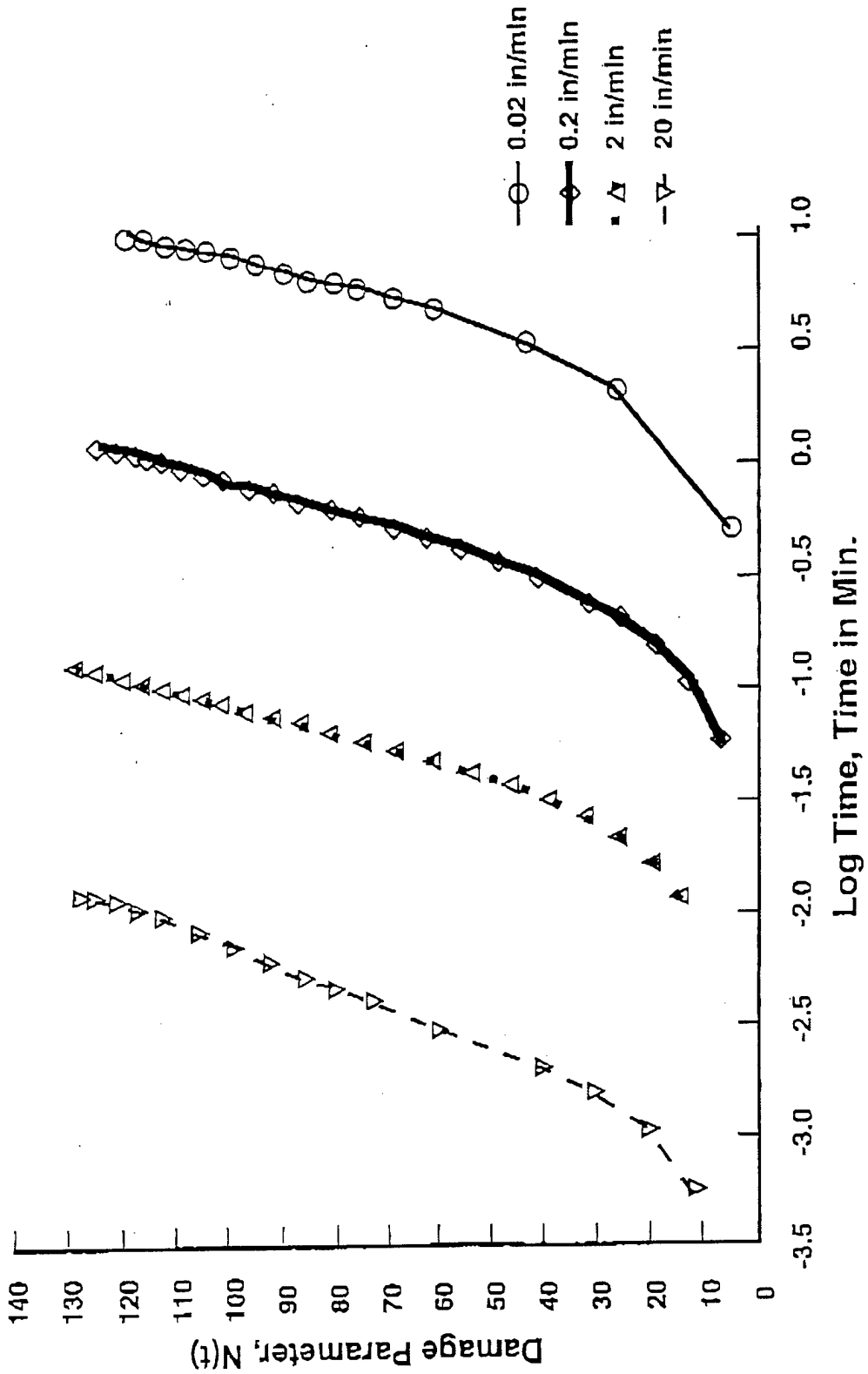
# Relative Change in Acoustic Attenuation Versus Strain

(constant strain rate loading)



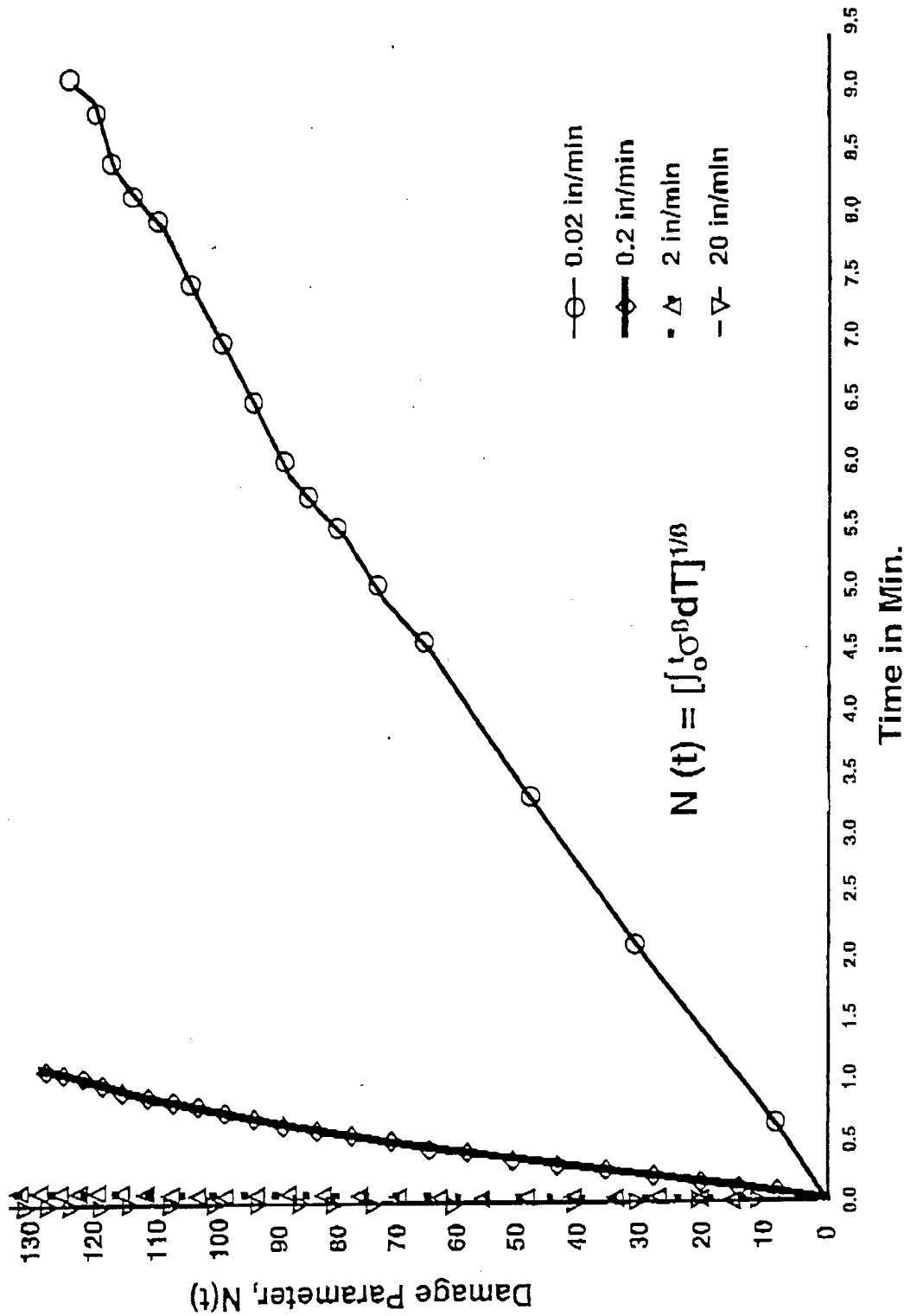


# Damage Parameters Versus Log Time at Different Strain Rates



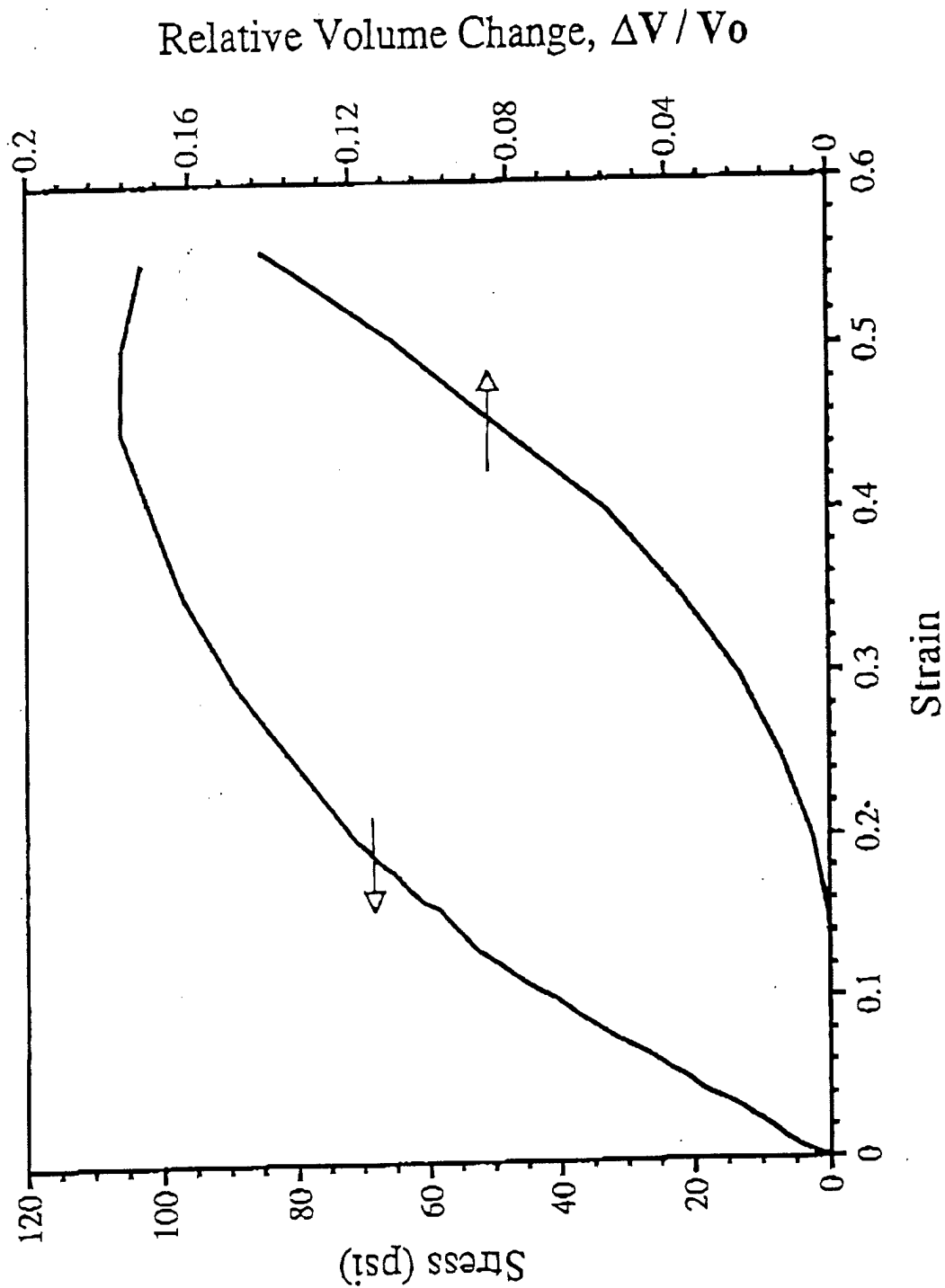


# Damage Parameters Versus Time at Different Strain Rates





# Material Behavior is Initially Linear and Incompressible; Following Dewetting, Response is Nonlinear and Compressible

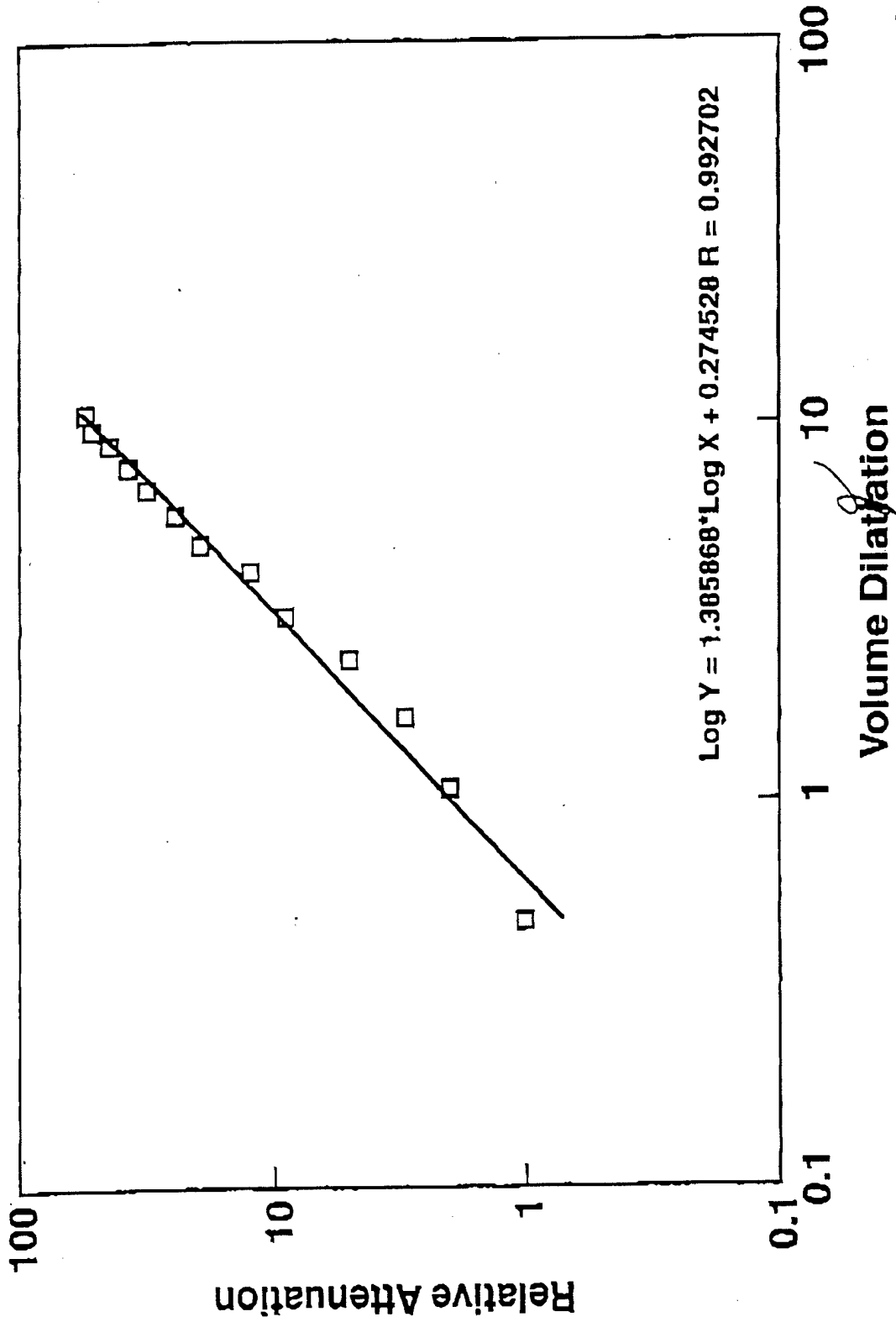




# Relative Attenuation of Acoustic Energy Versus Volume Dilatation

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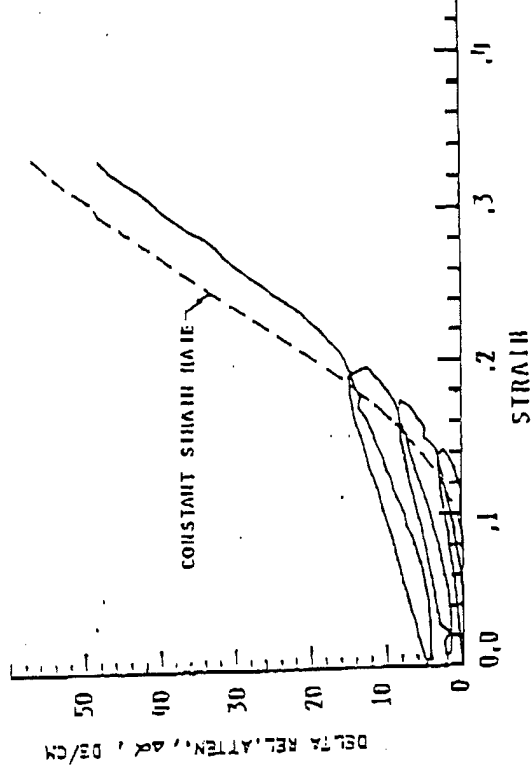
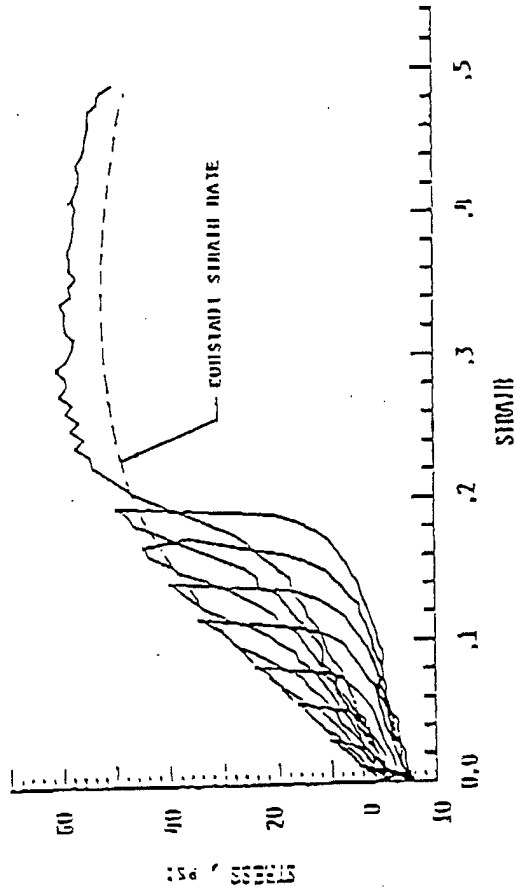
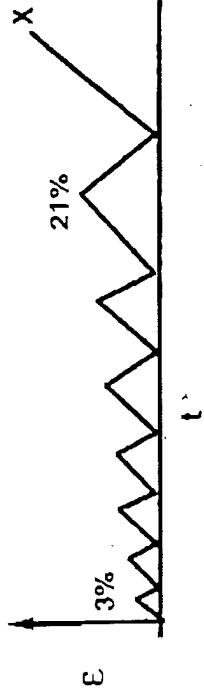
(monotonic loading)





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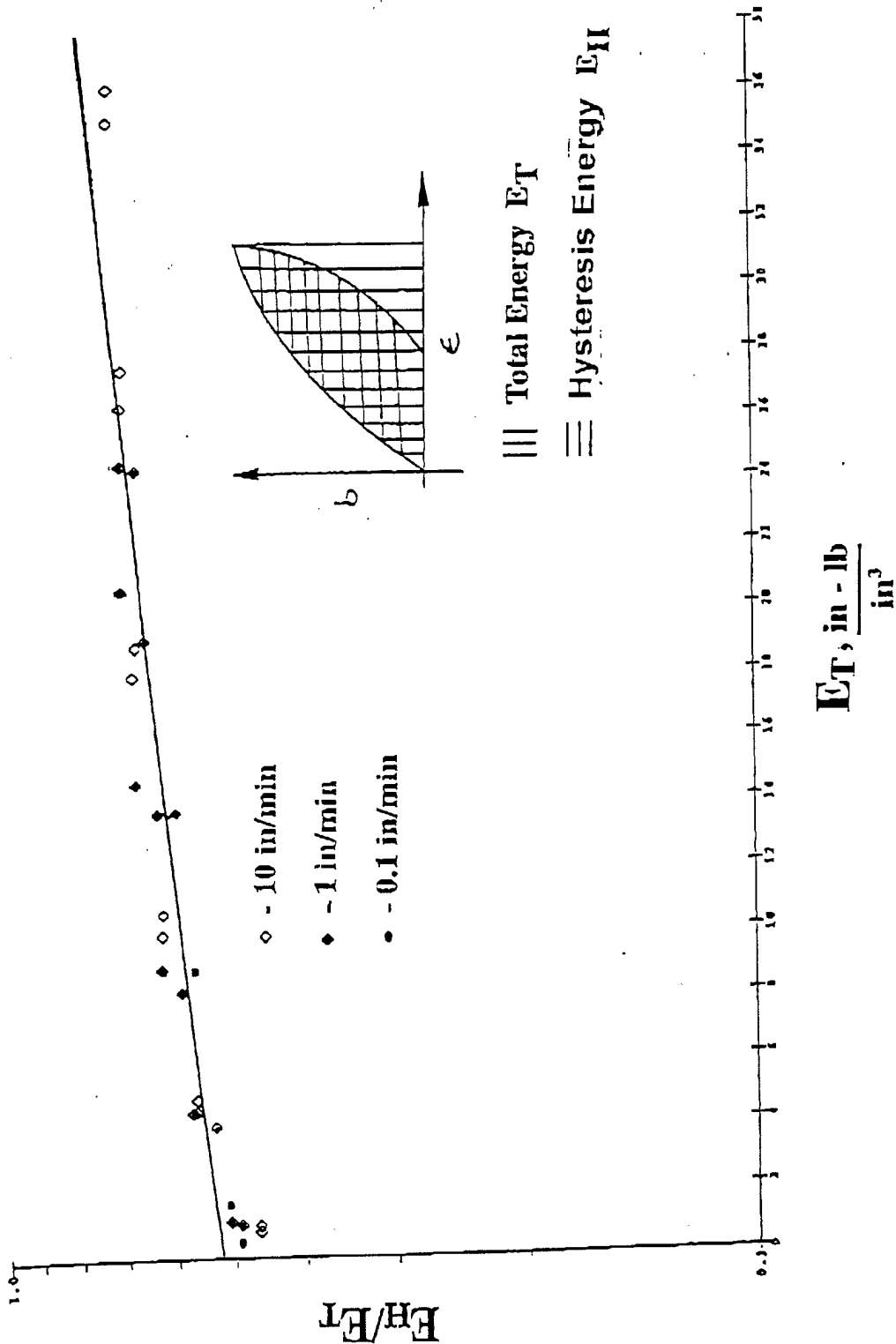
# Cycle Stress-Strain Behavior and Relative Change in Acoustic Attenuation Under Cycle Loading Condition

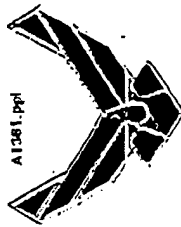




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# Ratio of Hysteresis Energy to Total Energy Versus Total Energy at Different Strain Rates





## Conclusions



- Strain rate has a large effect on damage intensity.
- Strain rate has no significant effect on the critical damage intensity.
- A good correlation exists between the NDE damage parameter and the material property.
- The cyclic stress-strain curves exhibit the typical stress softening phenomena.