

# REPORT DOCUMENTATION PAGE

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<b>a. REPORT</b>	<b>b. ABSTRACT</b>	<b>c. THIS PAGE</b>			Leilani Richardson
Unclassified	Unclassified	Unclassified	(A)		<b>19b. TELEPHONE NUMBER</b> (include area code) (661) 275-5015

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36 separate files are enclosed

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MEMORANDUM FOR PR (Contractor/In-House Publication)

FROM: PROI (TI) (STINFO)

06 Jul 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2000-148**  
C.T. Liu; J.N. Yang (UC Irvine), "Determination of Equivalent Initial Flaw Size in Particulate Composite Material"

**8<sup>th</sup> Specialty Conference on Probabilistic Mechanics and Structural Reliability (Statement A)**  
**(Notre Dame, IN, 24-26 Jul 00) (Submission Deadline: 18 Jul 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: \_\_\_\_\_  
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APPROVED/APPROVED AS AMENDED/DISAPPROVED

\_\_\_\_\_  
LESLIE S. PERKINS, Ph.D (Date)  
Staff Scientist  
Propulsion Directorate

20021119 135



**Distribution A: Approved for Public Release**

# **Determination of Equivalent Initial Flaw Size in a Particulate Composite Material**

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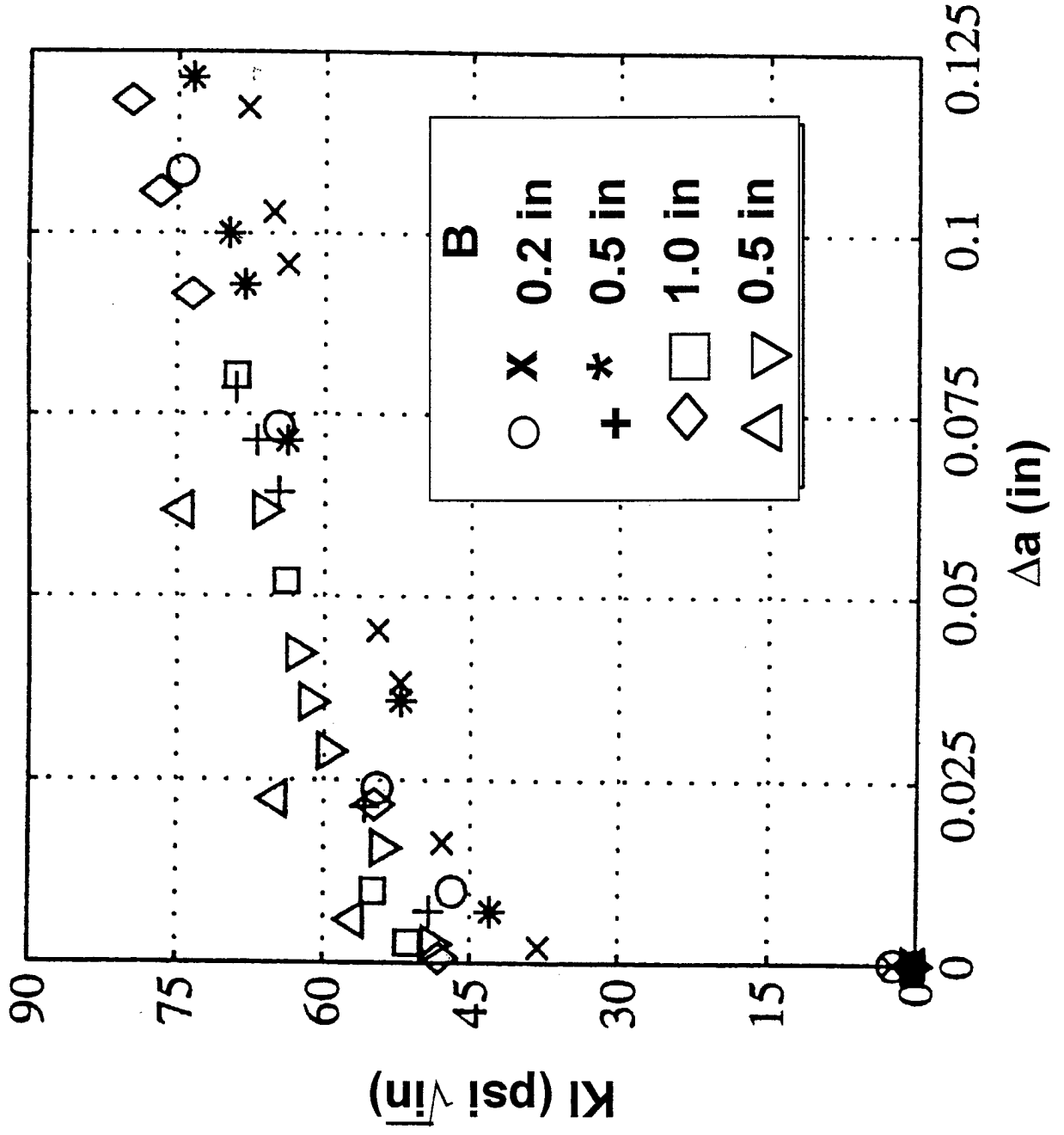


# Objectives

- Investigate the Effect of Specimen Thickness on the Equivalent Initial and the Critical Flaw Sizes in a Particulate Composite Material.
- Determine the Statistical Distribution Function of the Equivalent Initial and the Critical Flaw Sizes.
  - Normal Distribution
  - Two parameter Lognormal Distribution
  - Two Parameter Weibull Distribution
  - Second Asymptotic Distribution of Maximum Value

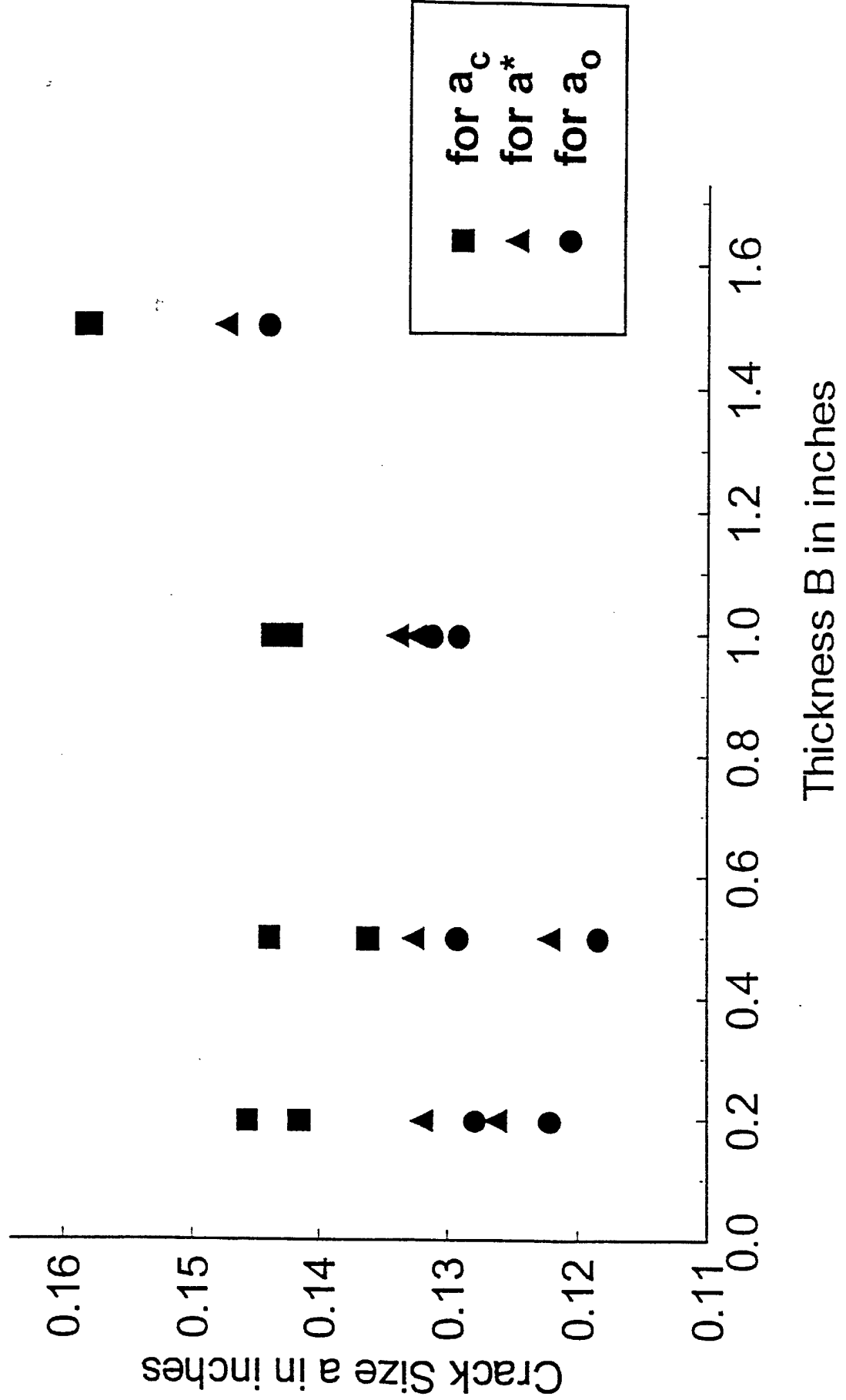


# Crack Growth Resistance Curve



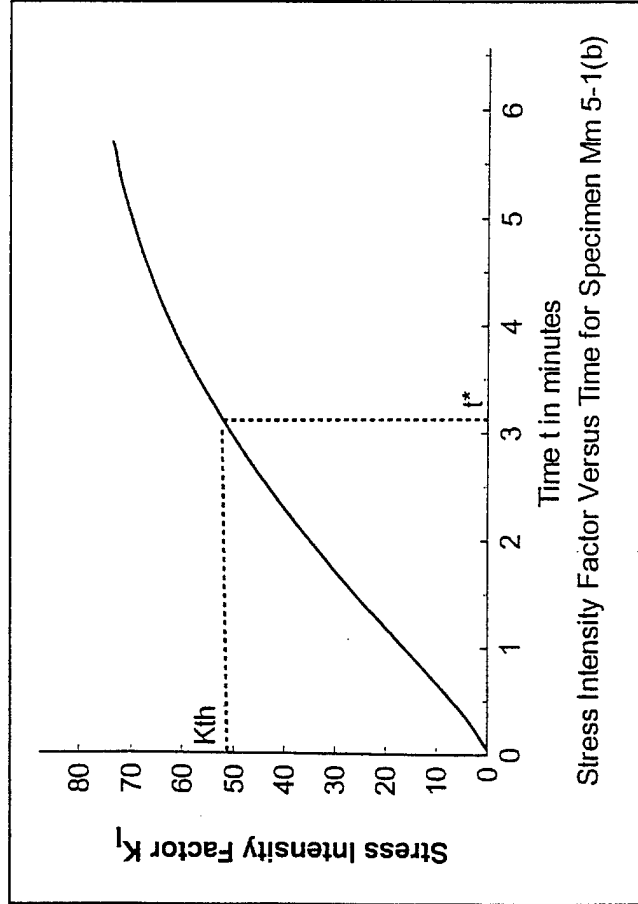


# Equivalent Initial Flaw Size and Critical Flaw Size

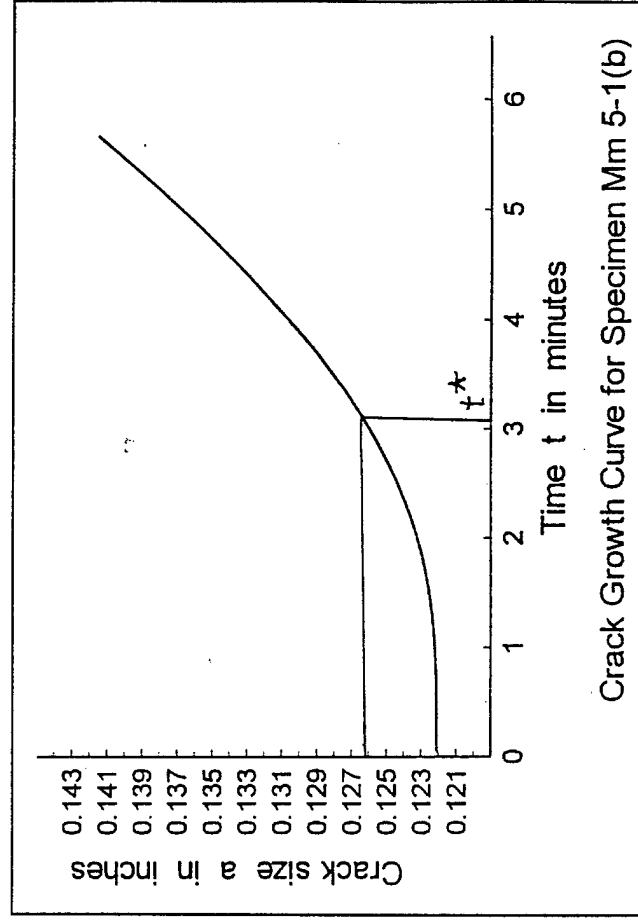




# Stress Intensity Factor Versus Time for Specimen Mm 5-1 (b)



**a**



**b**



# Equivalent Initial Flaw Size and Critical Flaw Size

lower case in plots

\*

lc

lc

lc

Test Specimen	Thickness B inches	Width W inches	$A_0$ inches	$A_i$ inches	$T^*$ minutes	$A_c$ inches
Mm 5-1b.mad	0.198	1.000	0.122088	0.1263	3.0755	0.1415
Mm 2-2.mad			0.127880	0.1320	2.9113	0.1456
Mm 5-1.mad	0.498	1.000	0.118401	0.1222	2.8465	0.1362
Mm 5-2.mad			0.129210	0.1327	2.7359	0.1439
Mm 1-1.mad	0.997	1.000	0.131190	0.1340	2.0768	0.1422
Mm 1-2.mad(a)			0.129168	0.1326	2.4384	0.1438
Mm 1-2.mad(a)	1.500	1.050	0.144033	0.1475	2.4900	0.1580
Mm 15-2.mad			0.144086	0.1475	2.4644	0.1584



# Distribution Parameters for Normal, Lognormal, Weibull and Asymptotic Distributions

	$A_0$	$A^*$	$A_c$
$\mu$	0.1308	0.1344	0.1462
$s$	0.0092	0.0090	0.0079
$\mu^*$	-2.037	-2.0092	-1.9242
$\sigma^*$	0.07021	0.06692	0.053961
$\alpha$	17.5546	18.4513	23.0450
$\beta$	0.1348	0.1383	0.1497
$k$	13.2524	13.80.81	17.1205
$\nu$	0.1258	0.2195	0.1419

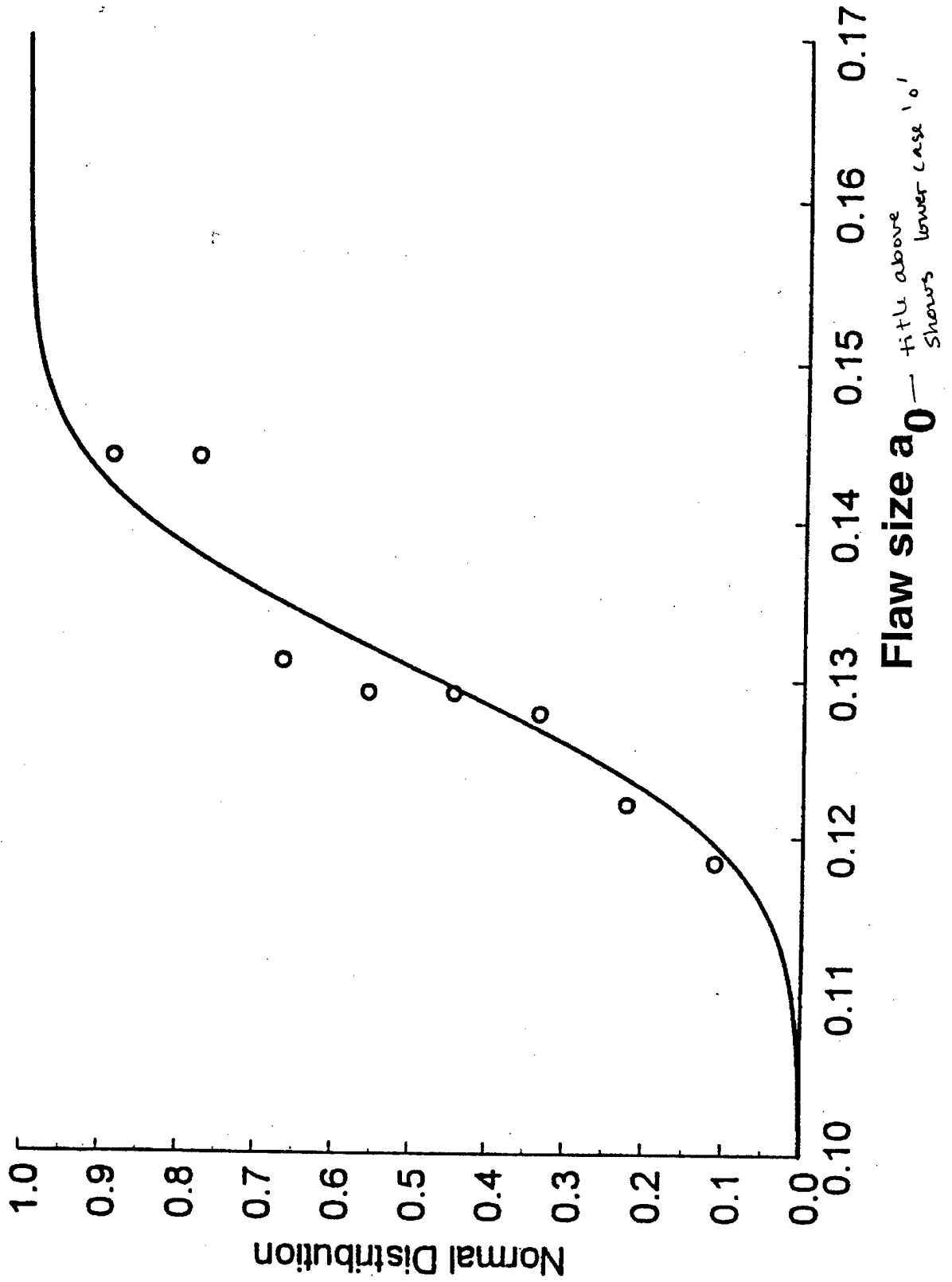


# Mean, Standard Deviation and Coefficient of Variation

	<i>Ac</i>	<i>A*</i>	<i>A<sub>o</sub></i>	<i>Ac</i>
Mean (in.)	0.1308	0.1344	0.1462	0.0079
Standard Deviation (in.)	0.0092	0.0090	0.0540	
Coefficient of Variation	0.0703	0.0670		

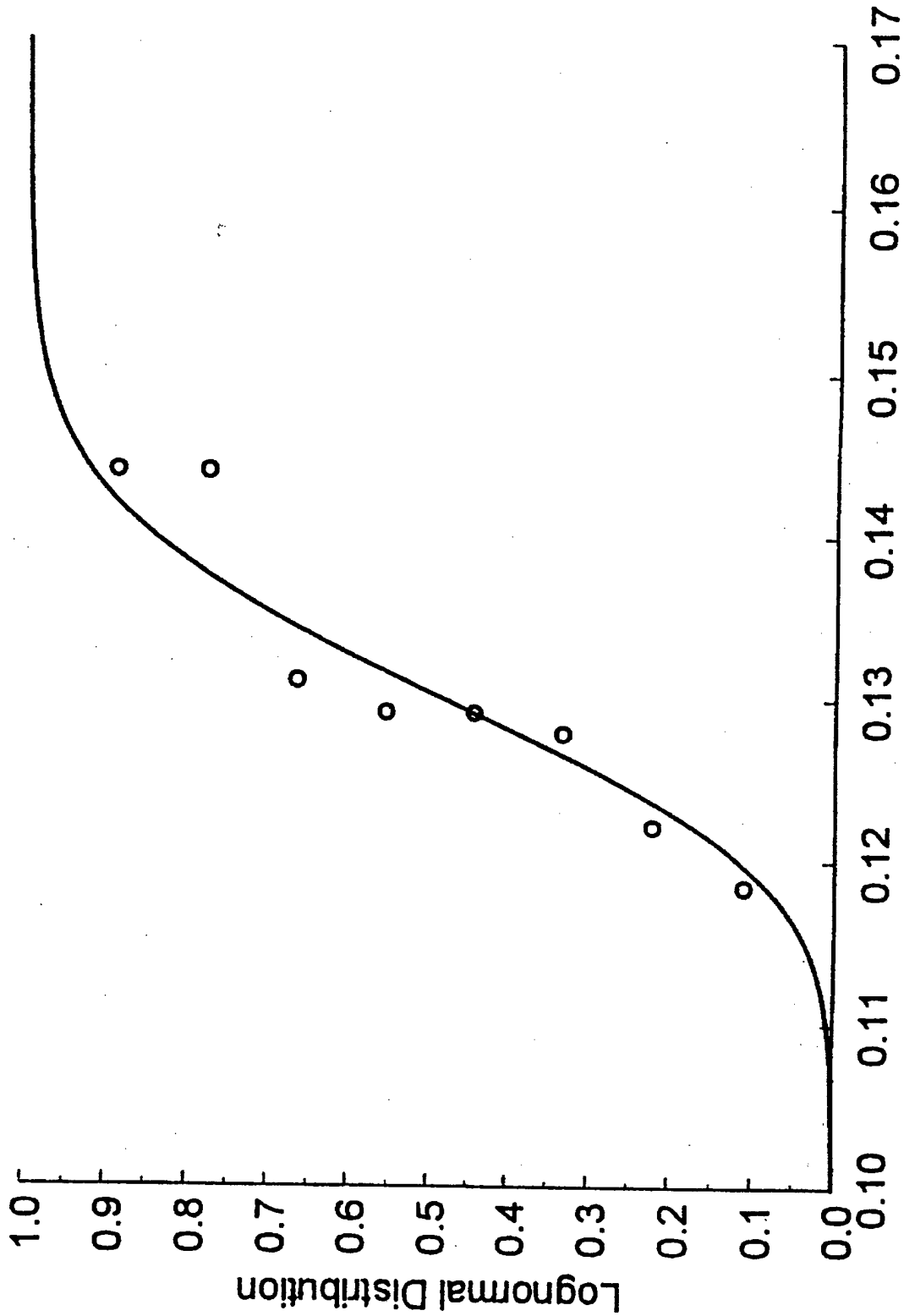


# Normal Distribution Plot for $a_0$





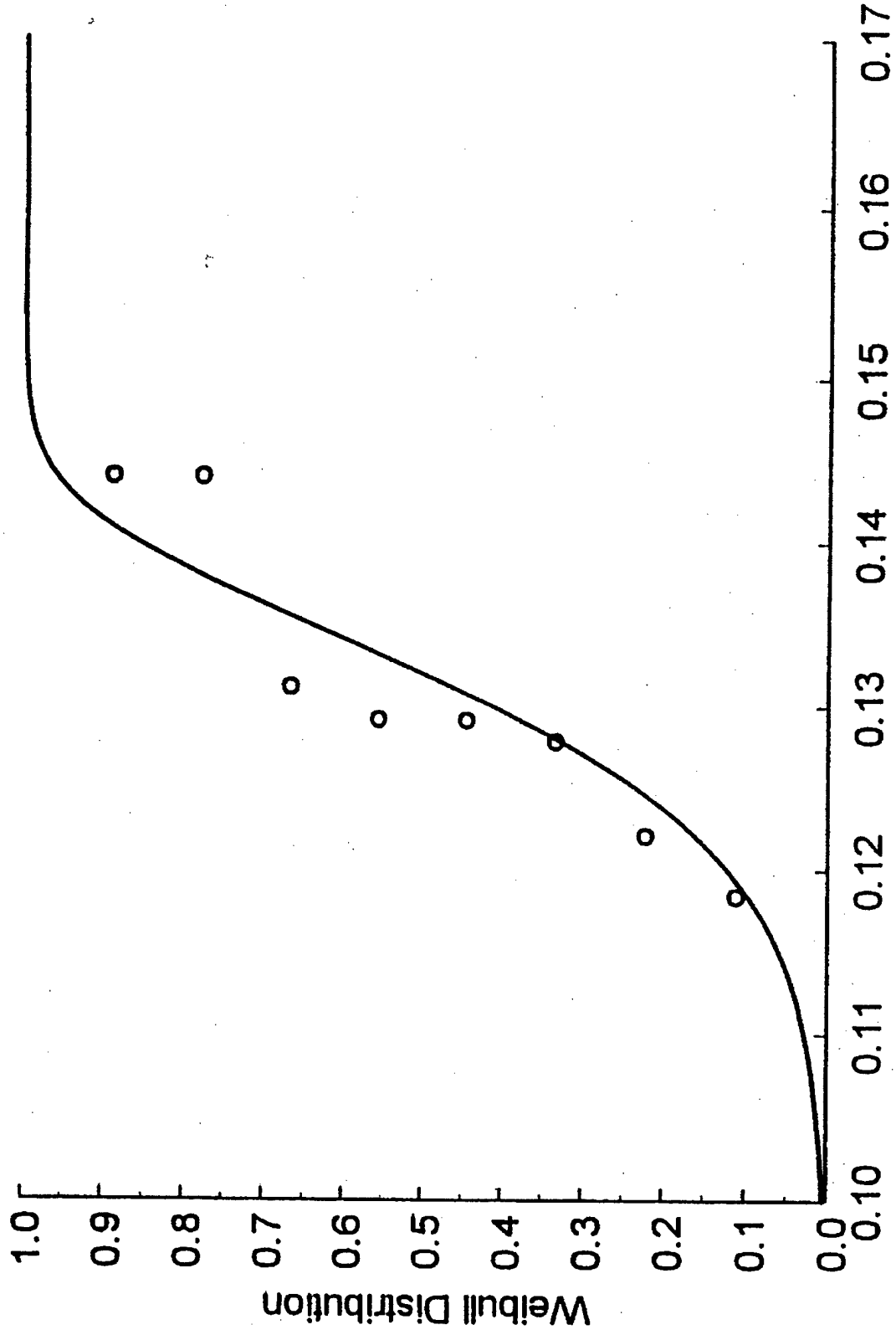
# Lognormal Distribution Plot for $a_0$



Flaw size  $a_0$  — should be letters '0' or 'zero'?



# Weibull Distribution Plot for $a_0$

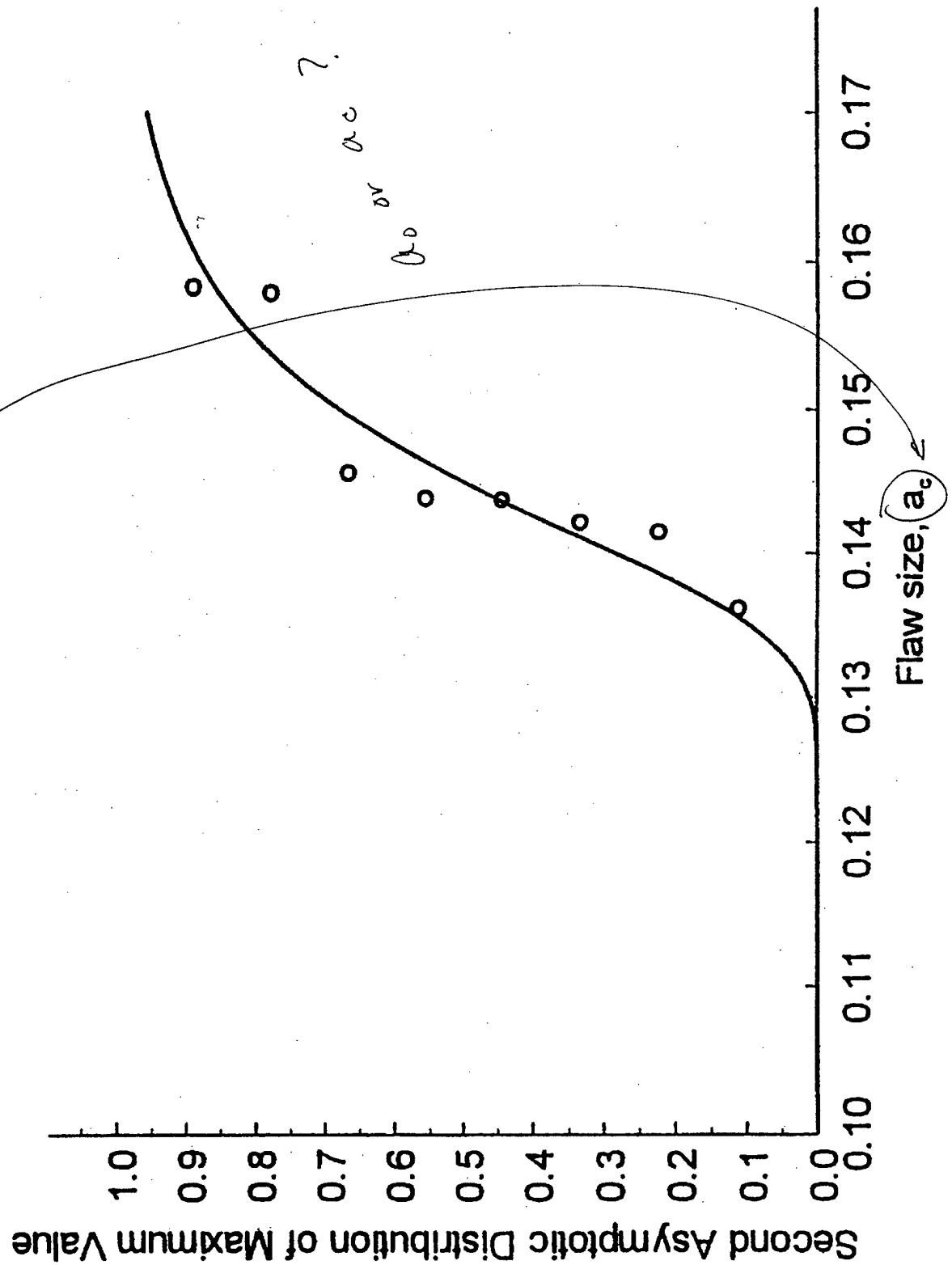


Flaw size  $a_0$  ← should be letter 'o' instead of 'zero'?



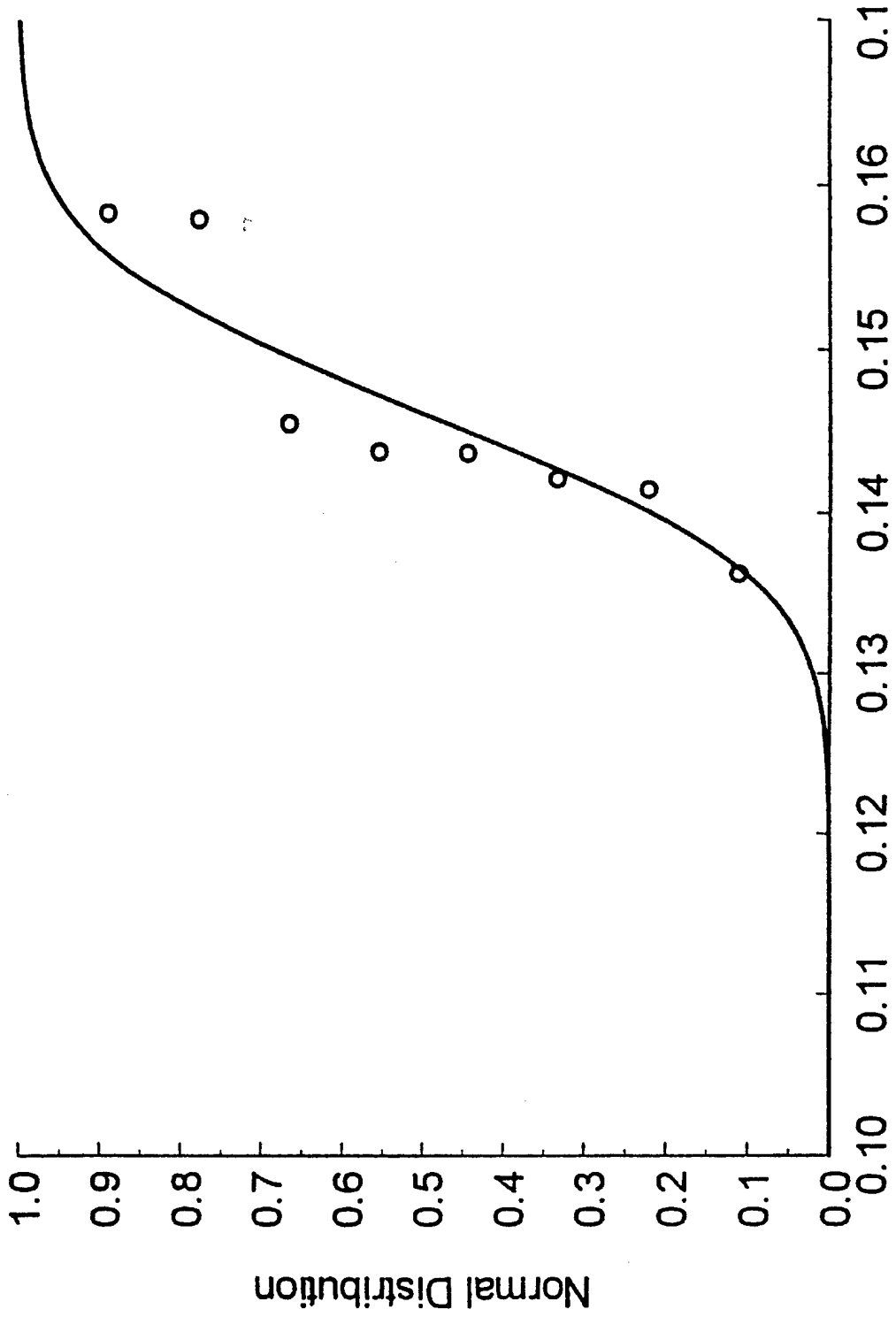
# Second Asymptotic Distribution Plot

for  $a_0$





# Normal Distribution Plot for $a_c$

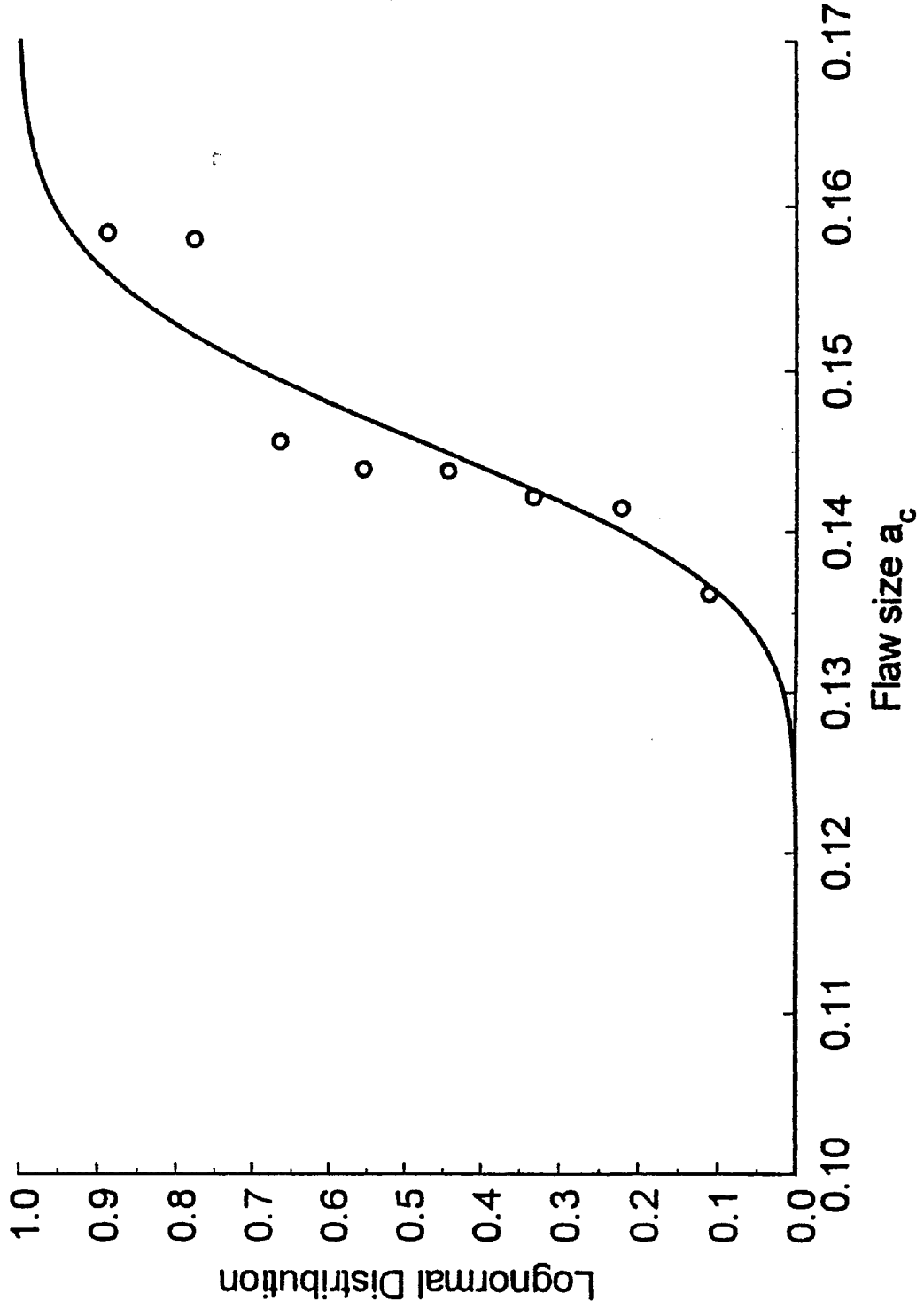


Flaw size  $a_c$

Normal Distribution plot for  $a_c$  already title at top



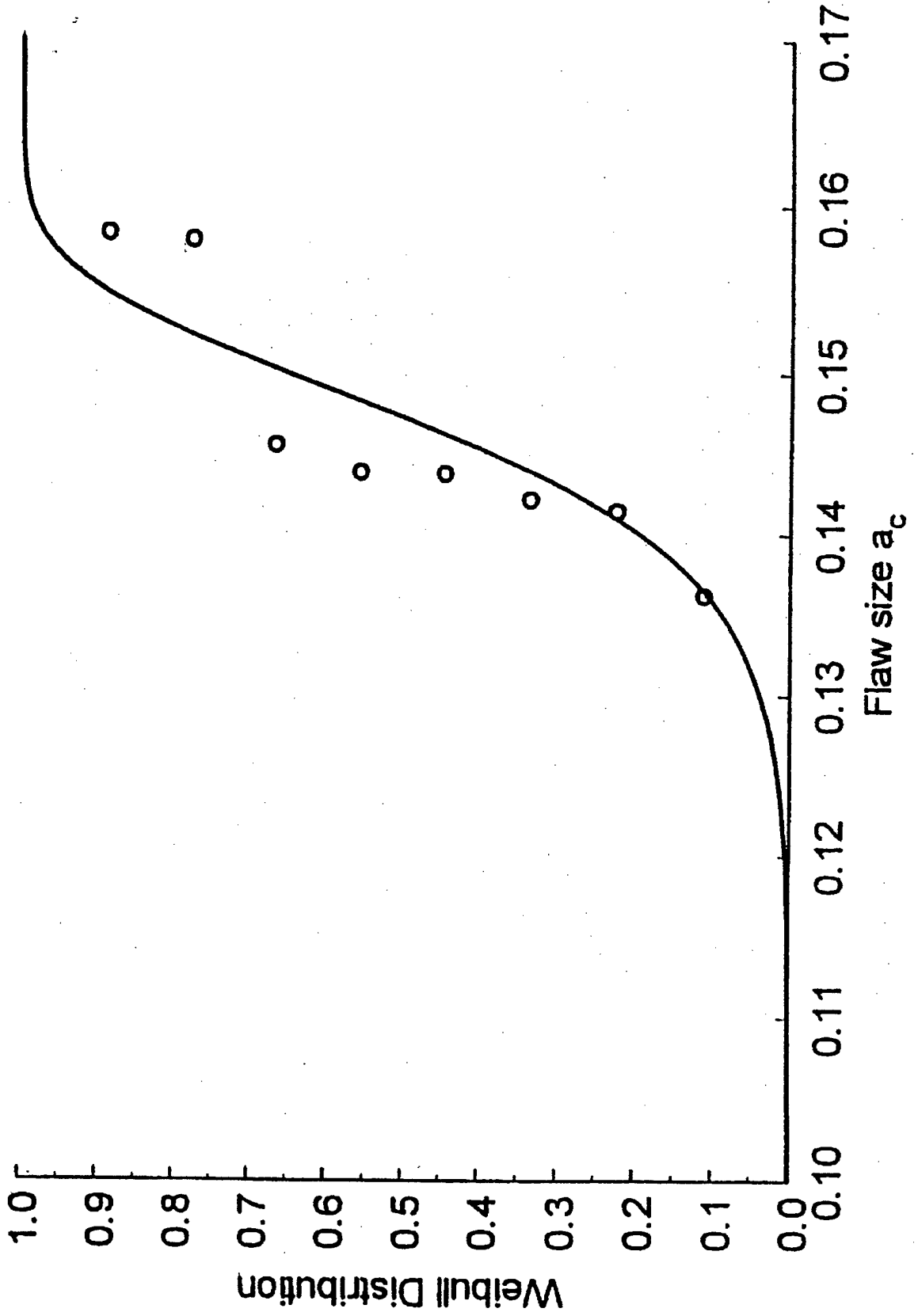
# Lognormal Distribution Plot for $a_c$



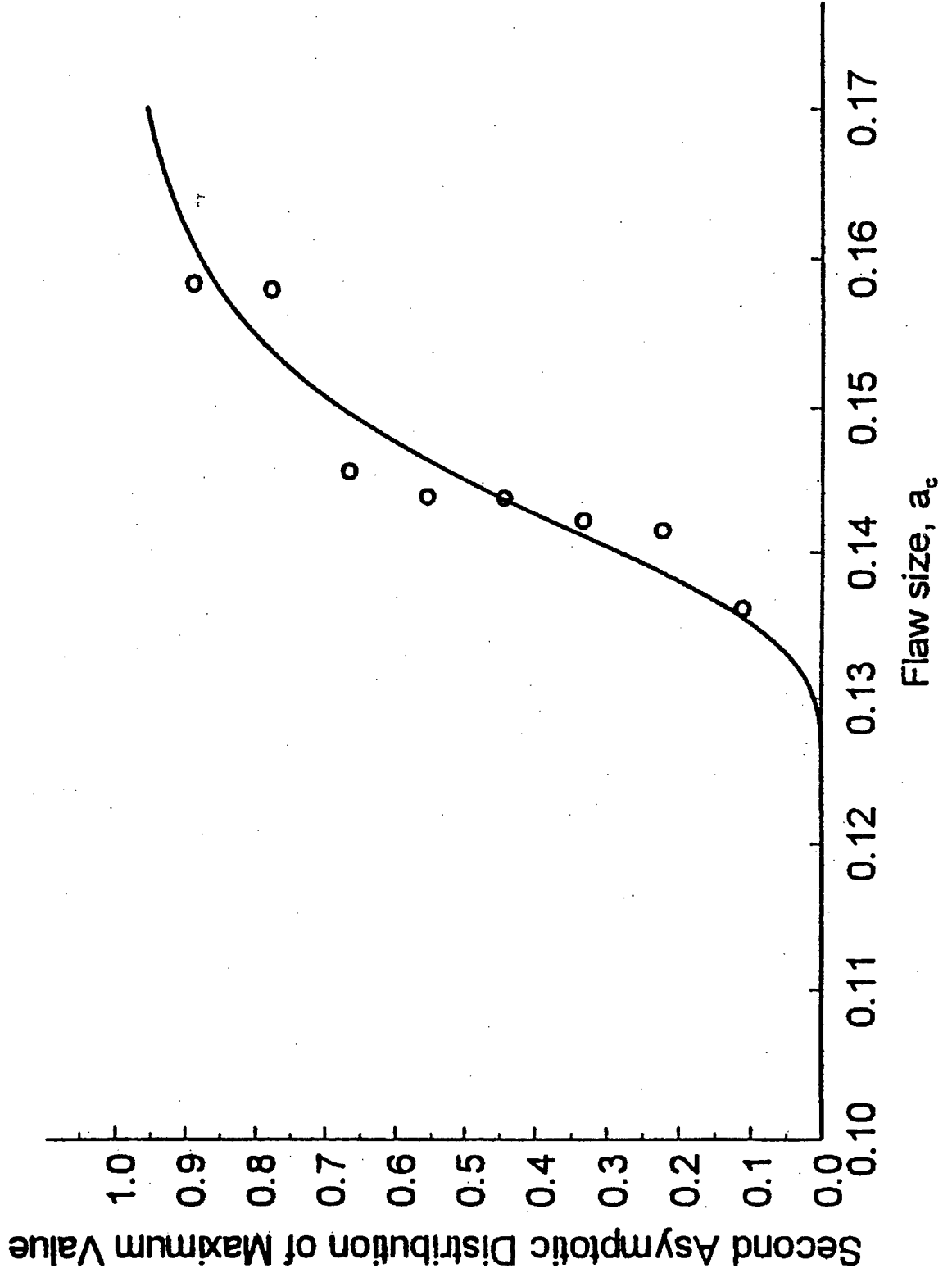
Lognormal Distribution plot for  $a_c$



# Weibull Distribution Plot for $a_c$



# Second Asymptotic Distribution Plot for $a_c$





# Conclusions

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- The equivalent initial and the critical flaw sizes are insensitive to the specimen thickness.
- The equivalent initial and the critical flaw sizes follow the second asymptotic distribution of the maximum value.