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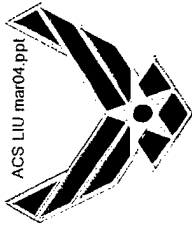
SEM Study of Deformation and Failure Mechanisms in Strained Elastomers



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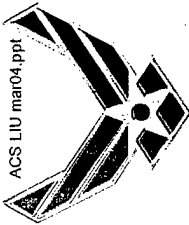
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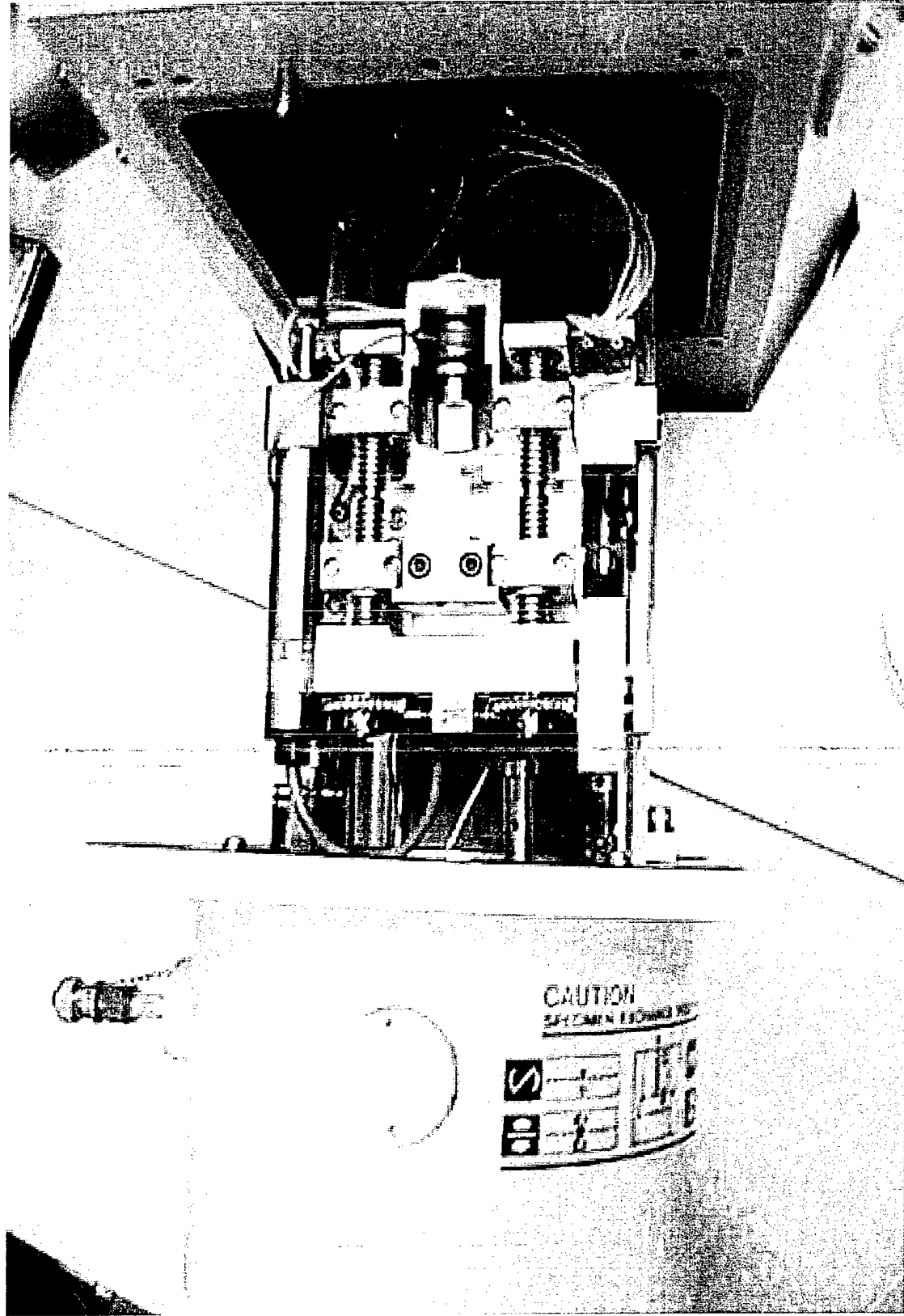
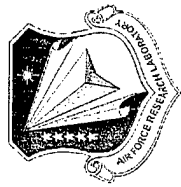
Objectives



- Investigate the deformation and failure mechanisms on meso and macro scales in a particulate composite and Solithane 113.
- Determine the strain fields on the meso and macro scales of the two materials.



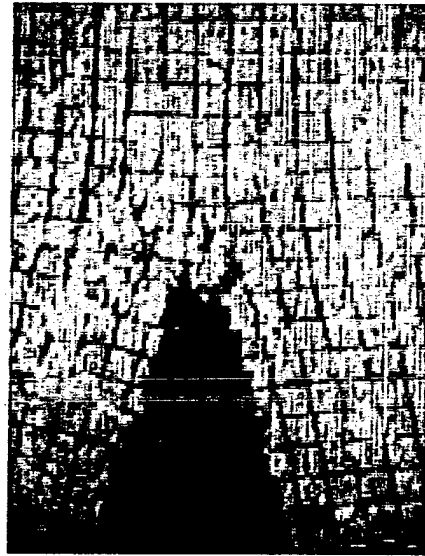
Testing Set-Up



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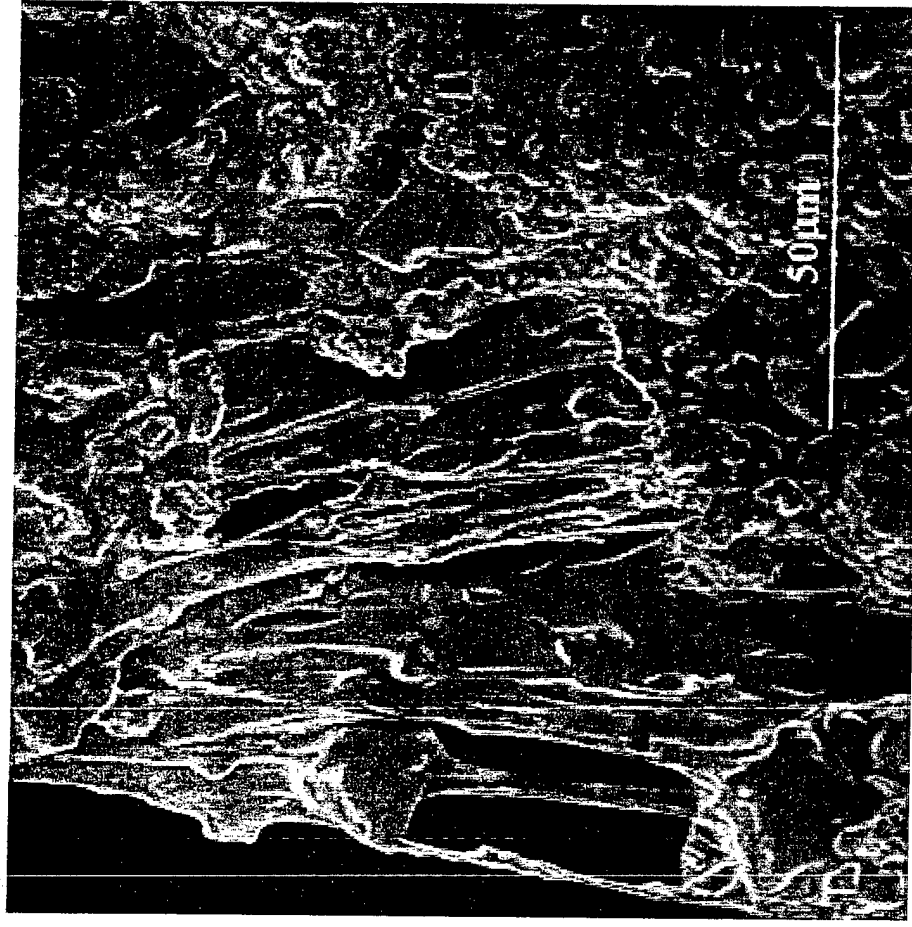
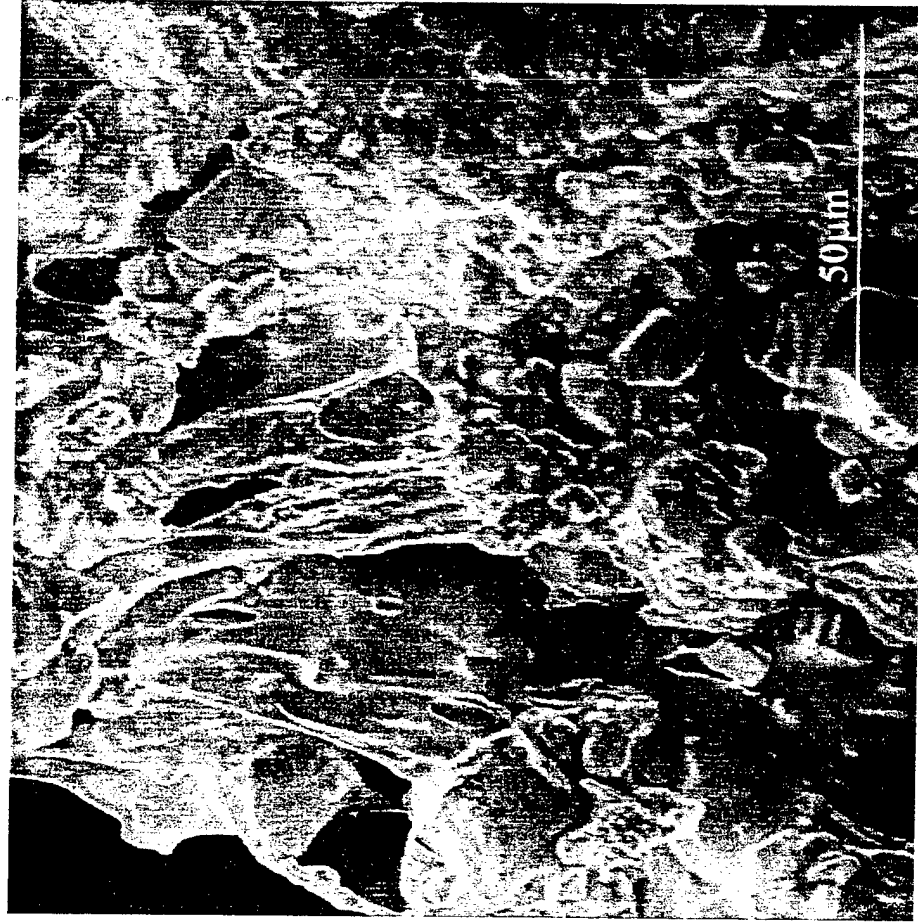


Crack Tip Profile



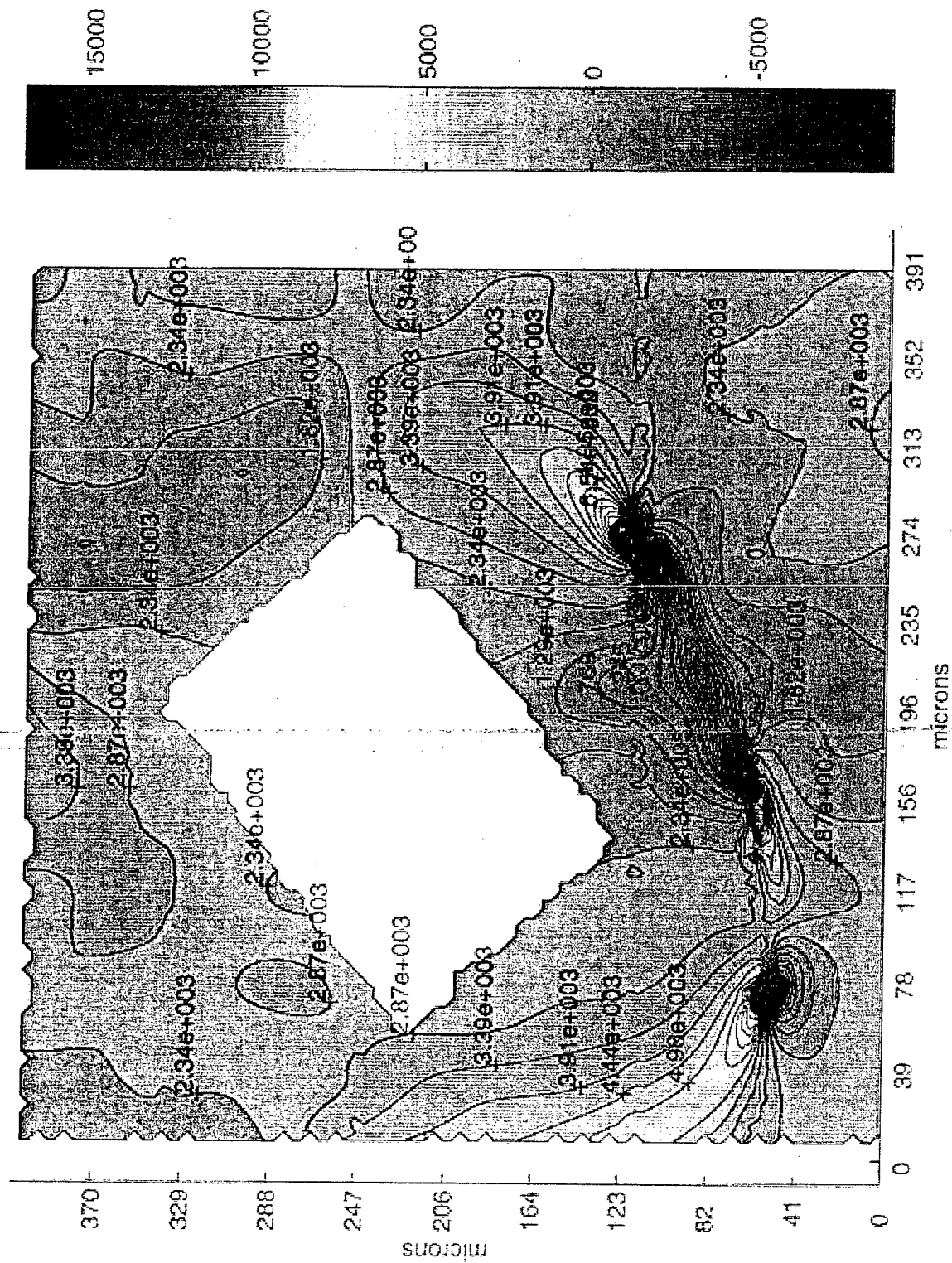
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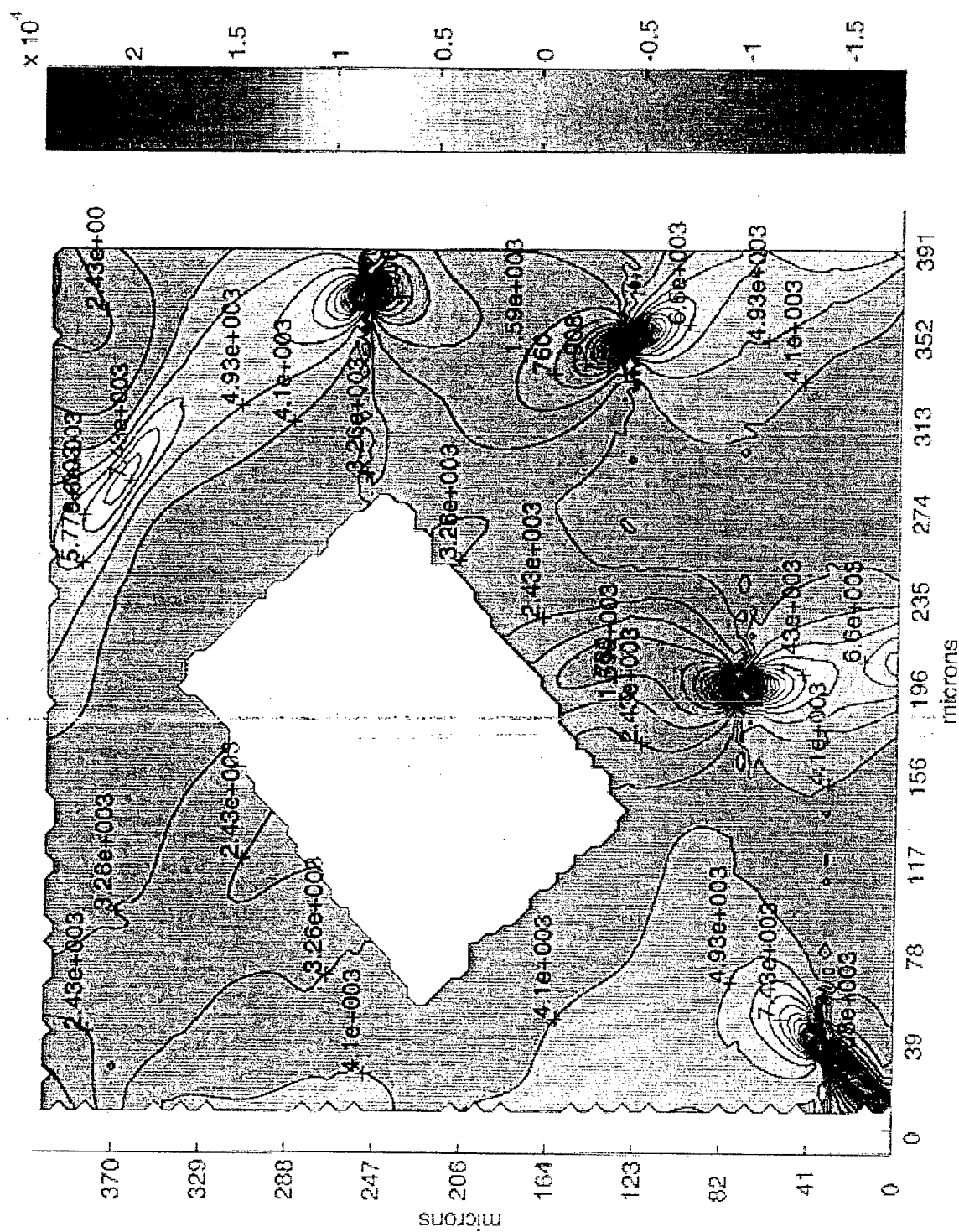
Local Damage at Crack Tip



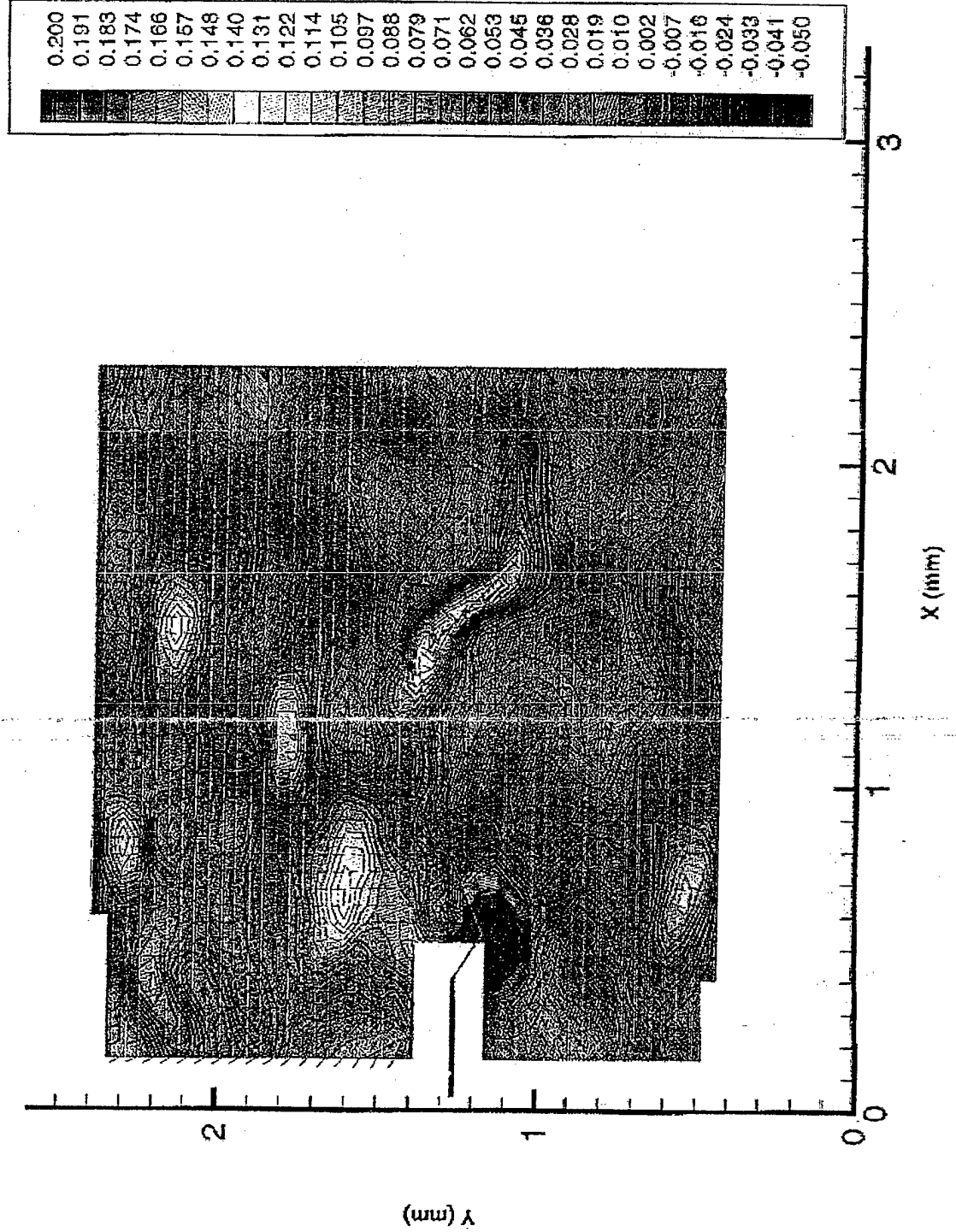


ϵ_x for 11.34 psi at 30 sec

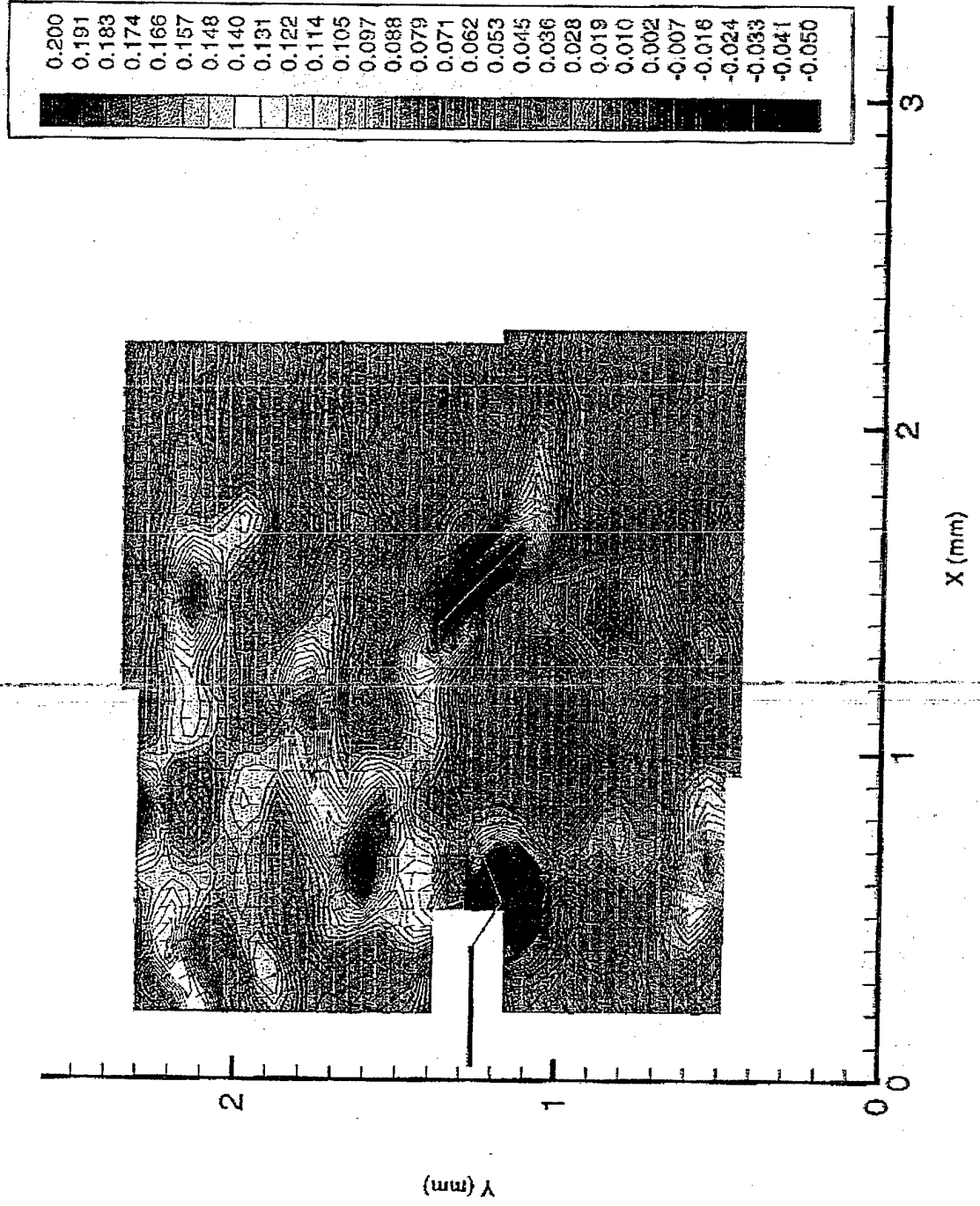


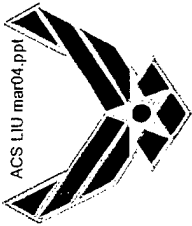


Maximum Principal Strain Distribution of 6.0% Far Field Strain During Loading



Maximum Principal Strain Distribution of 8.0% Far Field Strain During Loading



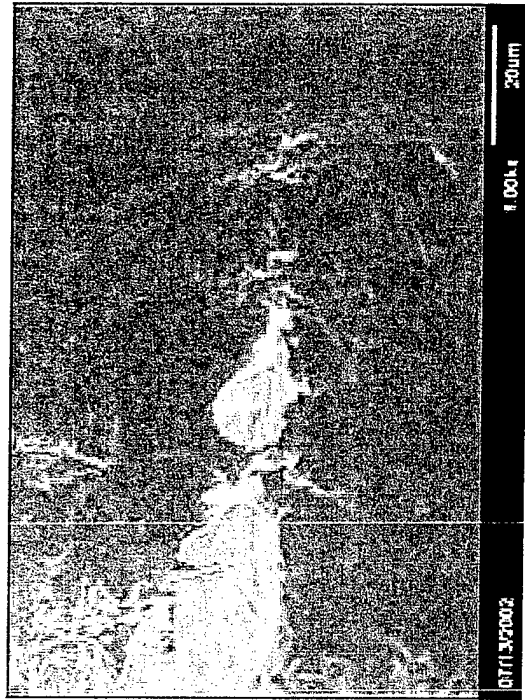
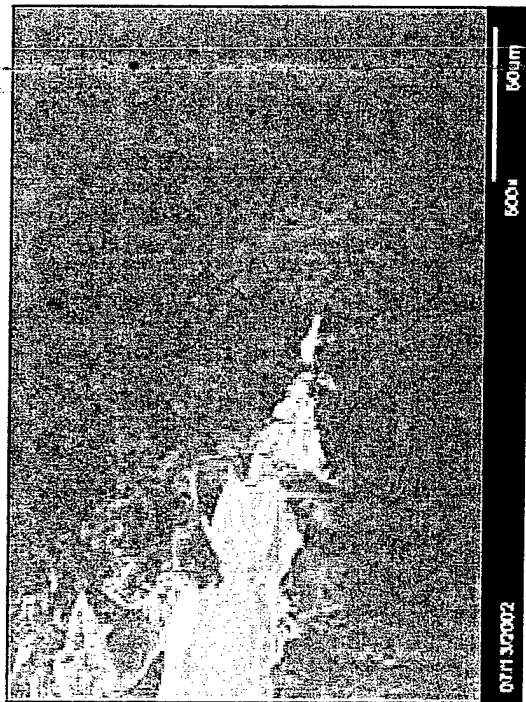
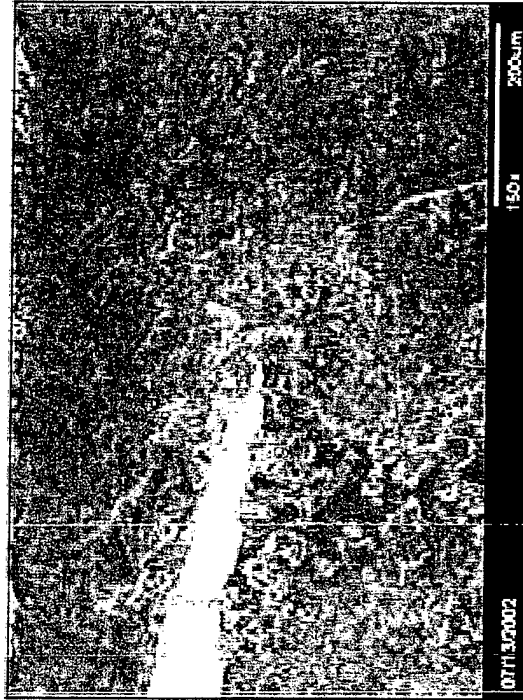


Side View of Crack Tip at 40x.



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Side View of Crack Tip at 150x, 400x, 500x, and 1000x.



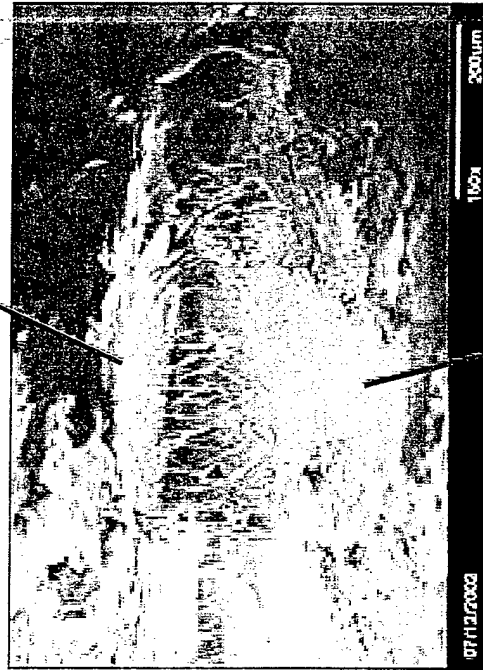
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SEM Pictures of Top View of Crack Tip at 150x and 250x.



Upper surface of the crack

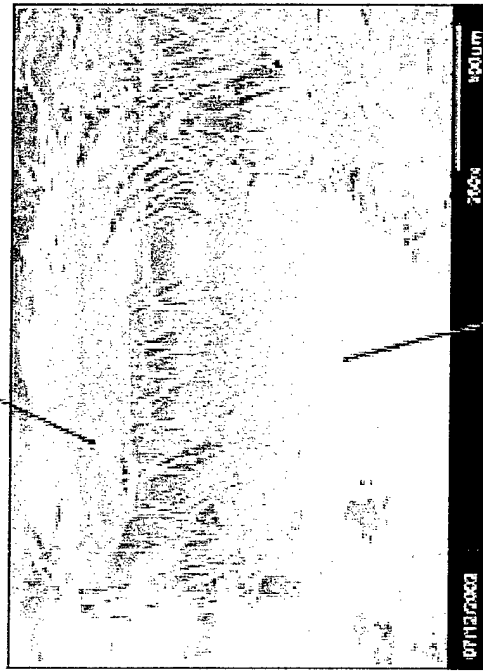


Crack tip

Crack tip
Crack tip

Lower surface of the crack

Upper surface of the crack

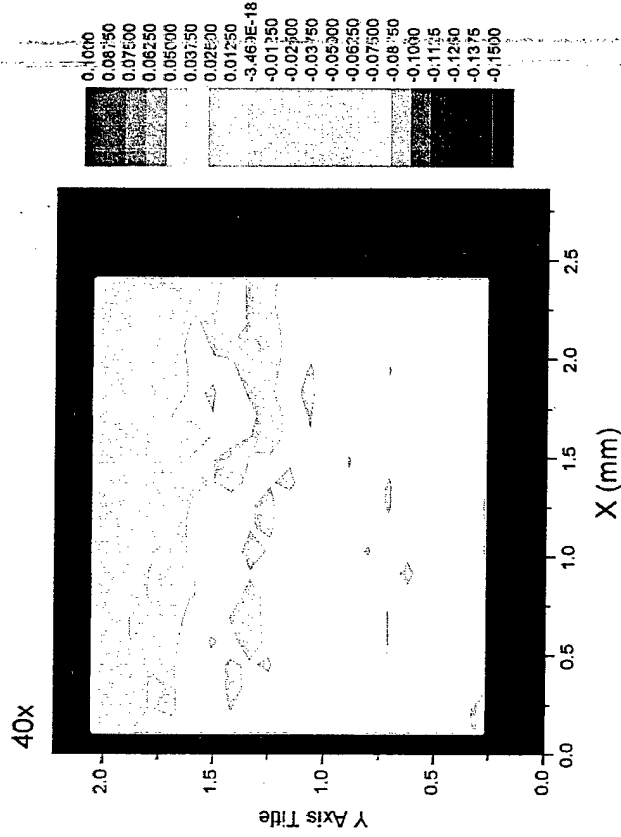


Lower surface of the crack

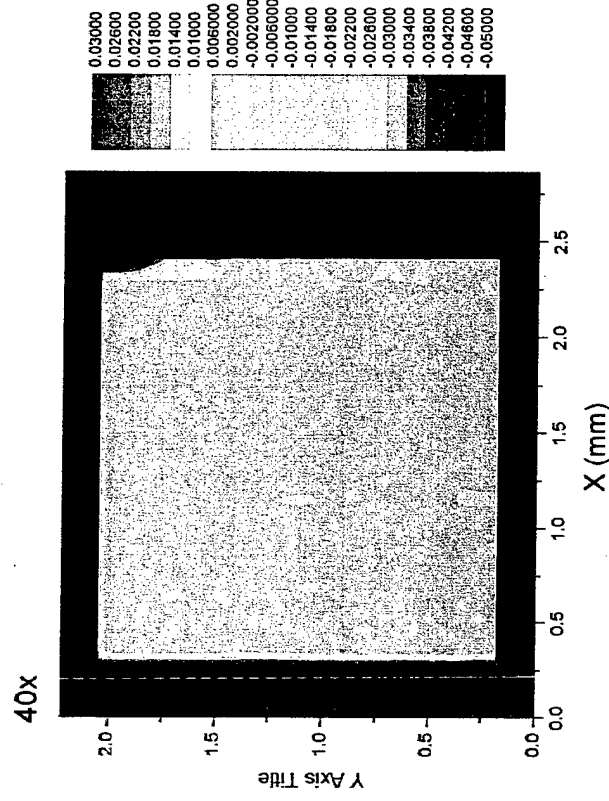
Crack tip

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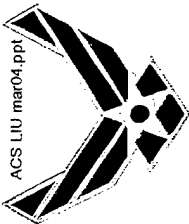
Strain Distributions (2.5mm x 2.0mm)



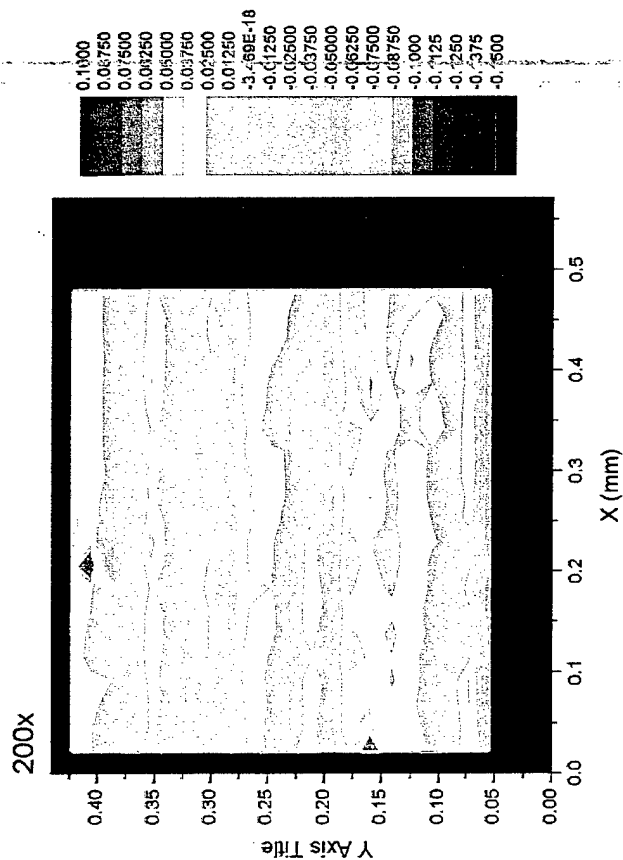
ϵ_{yy} field, Load = 52 grams



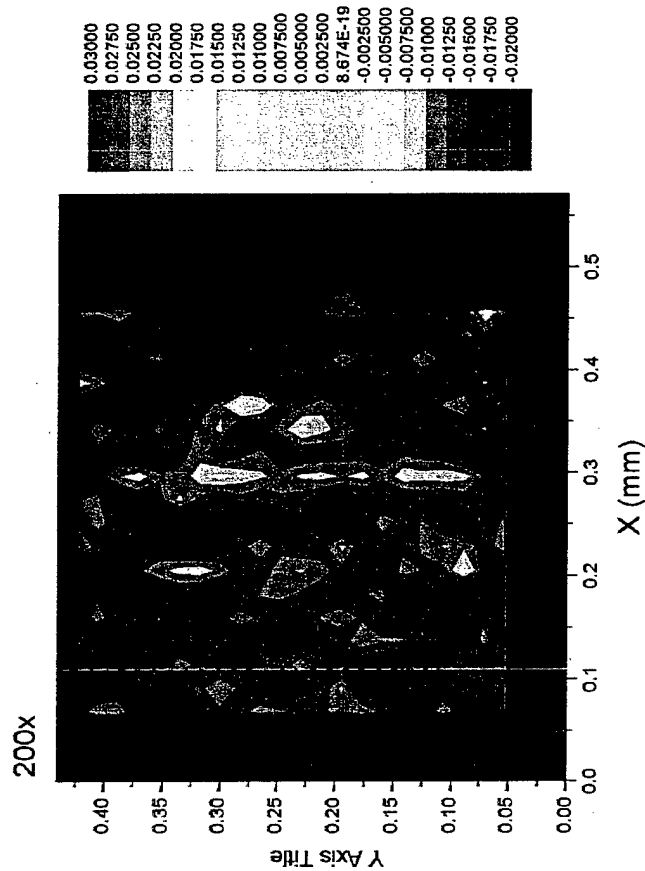
ϵ_{xx} field, Load = 52 grams



Strain Distributions (0.5mm x 0.45mm)



ϵ_{yy} field, Load = 47 grams

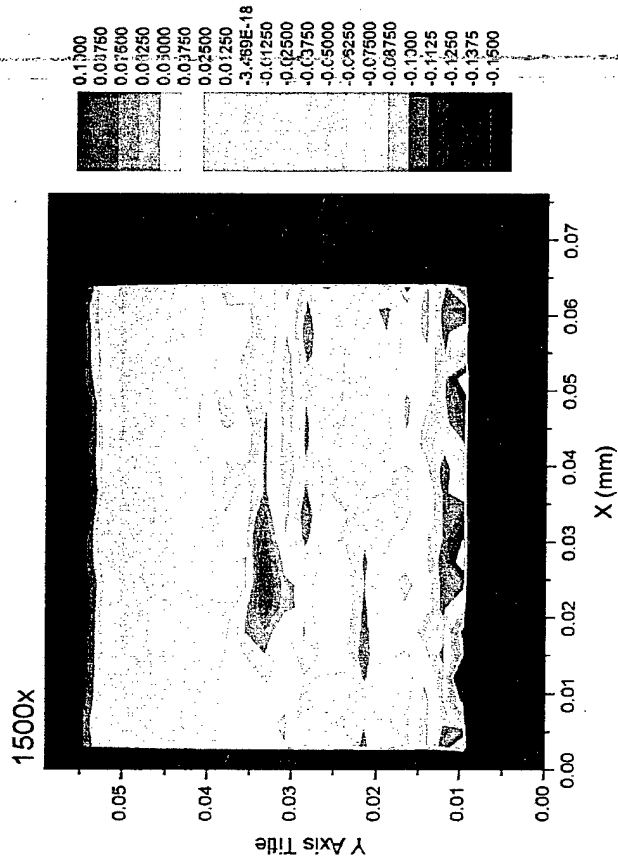


ϵ_{xx} field, Load = 47 grams

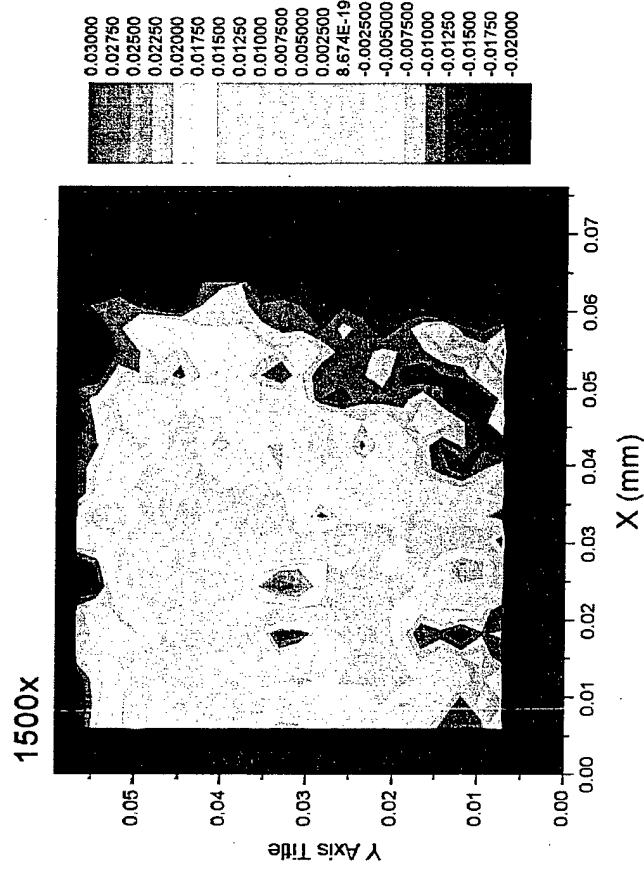
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Strain Distributions (0.065mm x 0.055mm)



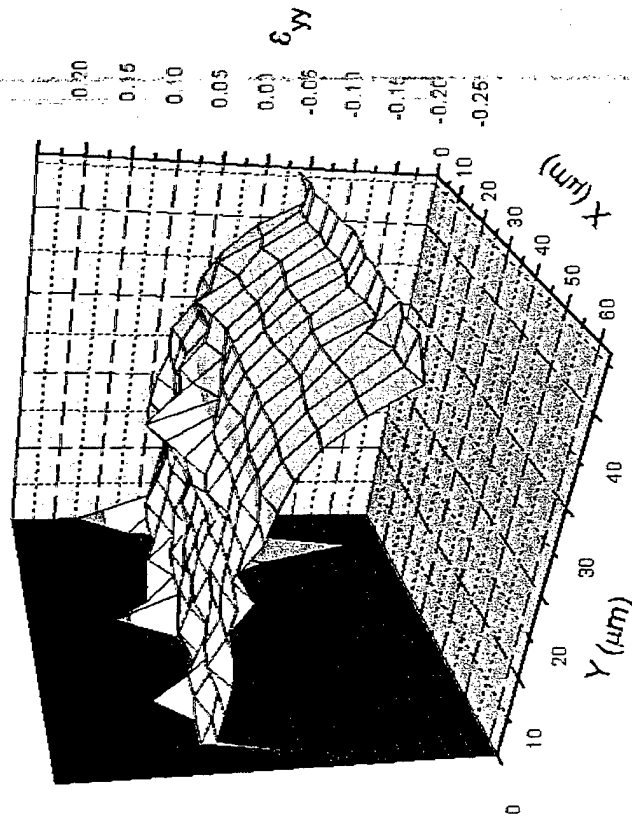
ϵ_{yy} field, Load = 49 grams



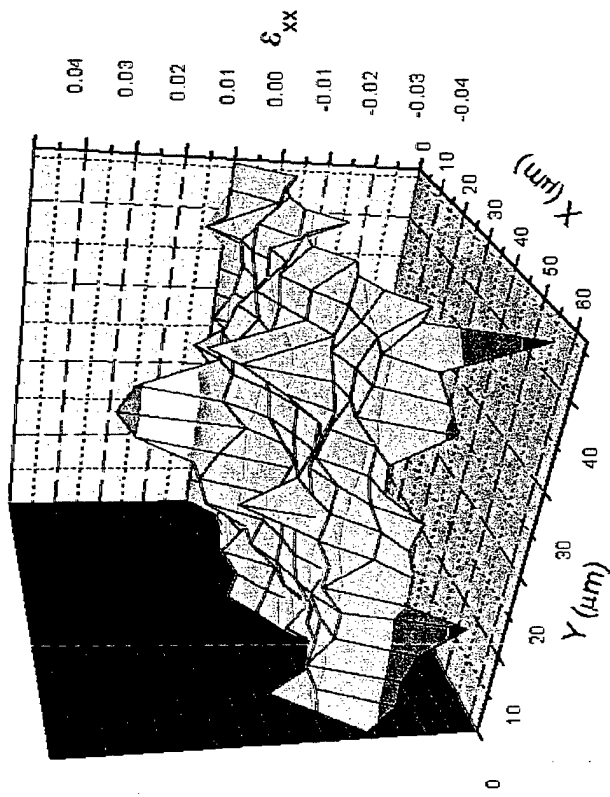
ϵ_{xx} field, Load = 49 grams

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Strain Distributions (0.065mm x 0.055mm)



ϵ_{yy} field (3-D), Load = 49 grams



ϵ_{xx} field (3-D), Load = 49 grams



Conclusions



- On the meso-scale, microstructure has a significant effect on the strain distributions.
- The basic crack growth mechanism consists of the coalescence of voids with the crack tip.
- The local deformation, damage mechanism, and crack growth mechanism in the two materials are similar.
- In the two materials, highly damaged regions, or failure process zones, are formed at the crack tip.