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Investigating the Effect of Interfacial Strength on Deformation and Failure Mechanisms in Bond Systems



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Objectives:

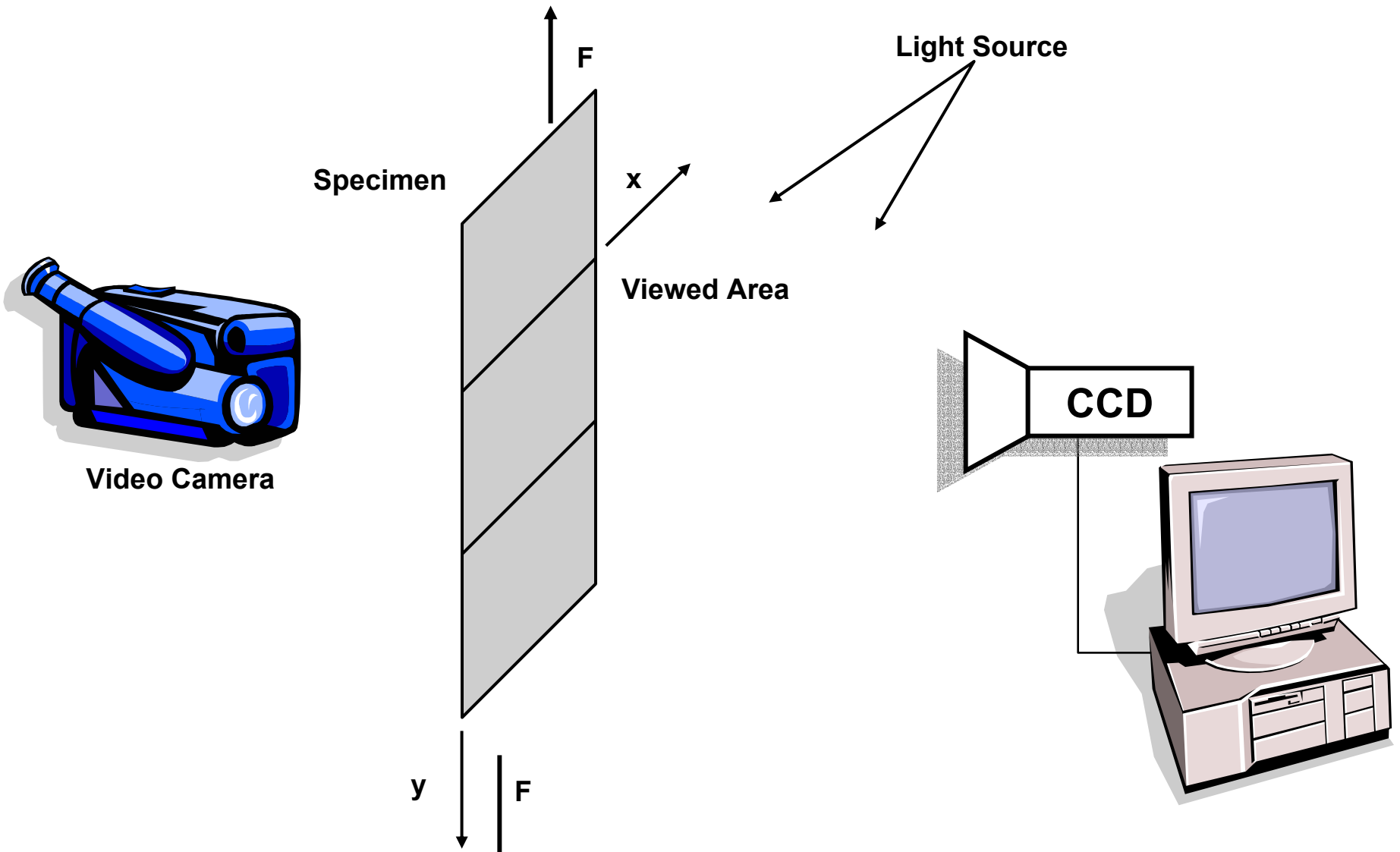


- **Investigate the Effects of Interfacial Strength on Deformation and Failure Mechanisms in Bi-Material Bonded Specimens under a 0.01 in/min Constant Displacement Rate Condition.**
- **Determine the Strain Rate Distribution in the Bi-Material Bonded Specimens.**

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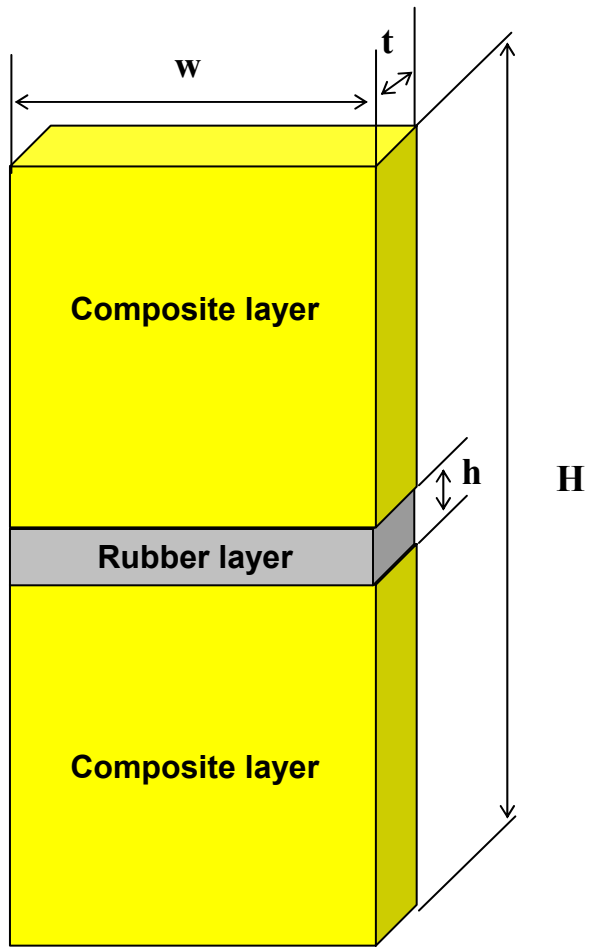


Experimental Set Up





Specimen Geometry



$w = 0.5$ in.

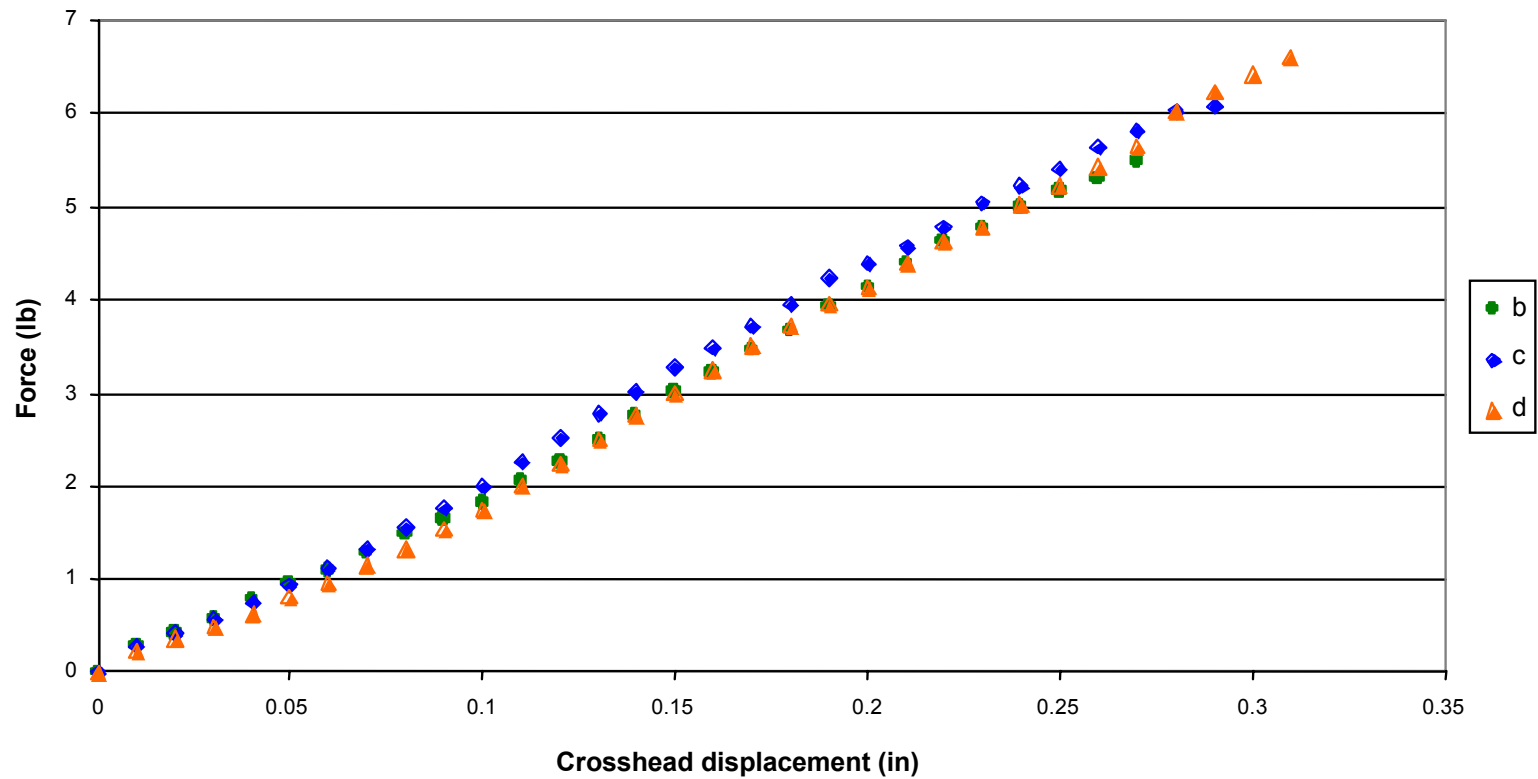
$t = 0.2$ in.

$h = 0.1$ in.

$H = 4$ in.



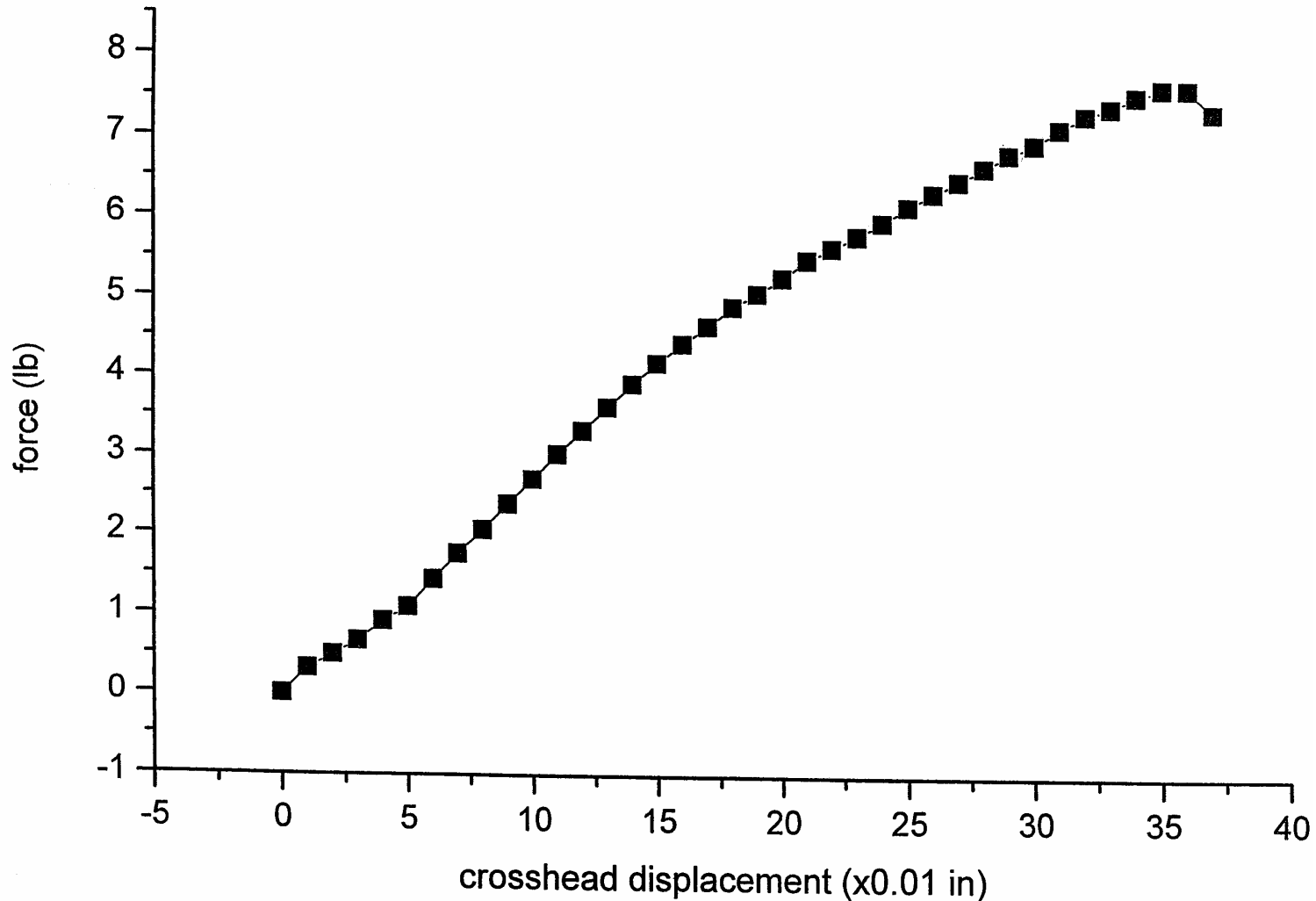
Force Versus Displacement Curves (specimen with strong interfacial strength)



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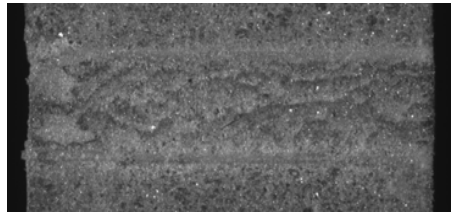
Force Versus Displacement Curves (specimen with weak interfacial strength)



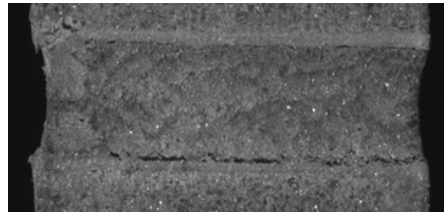
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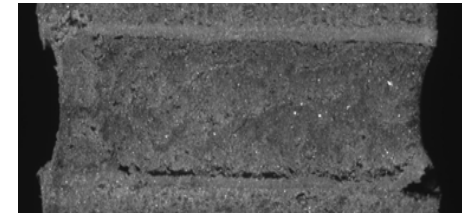
Mechanism of Debonding (specimen with strong interfacial strength)



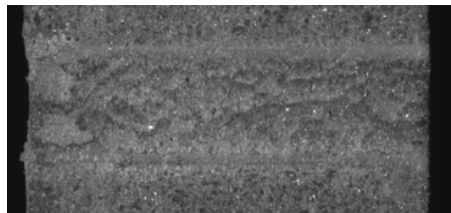
0
min



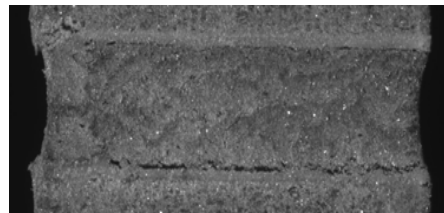
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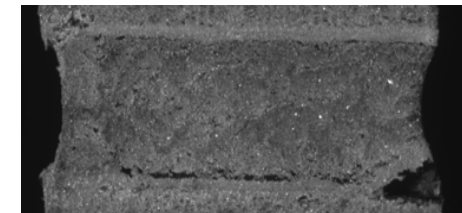
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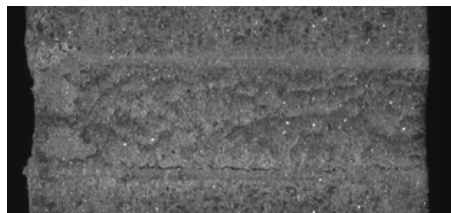
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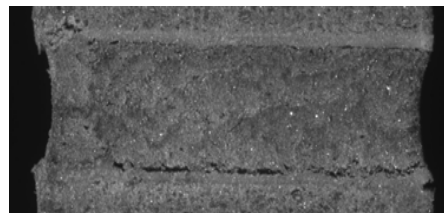
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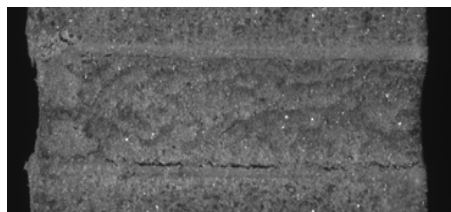
32 min
40 sec



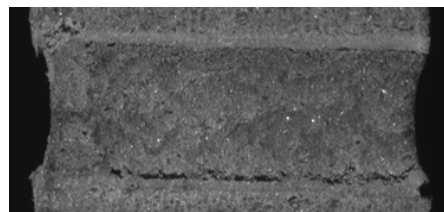
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28
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20
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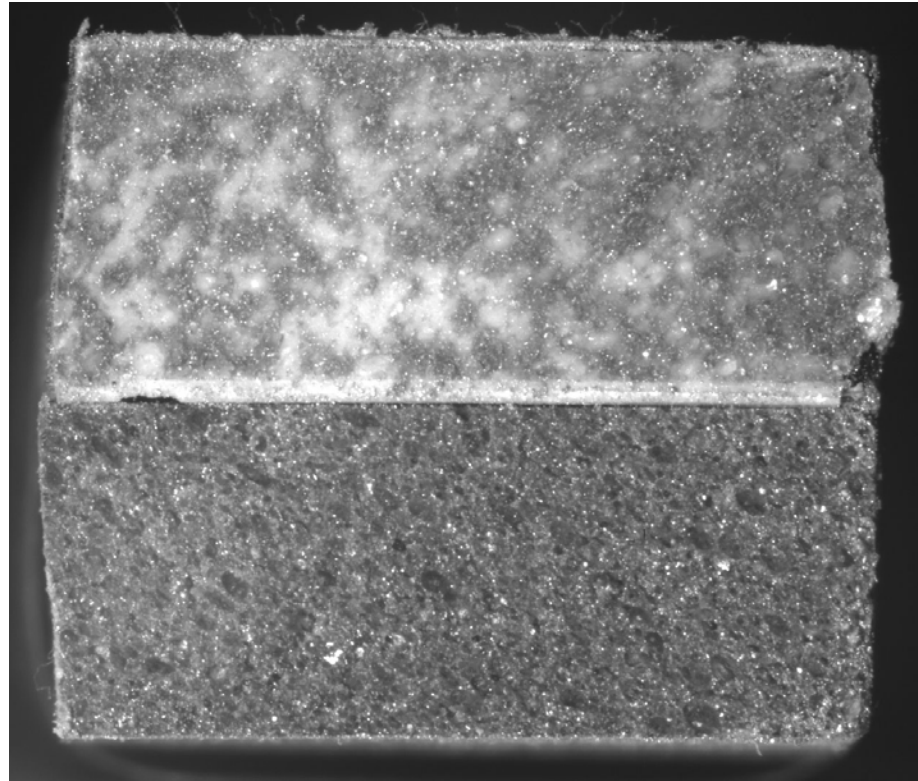
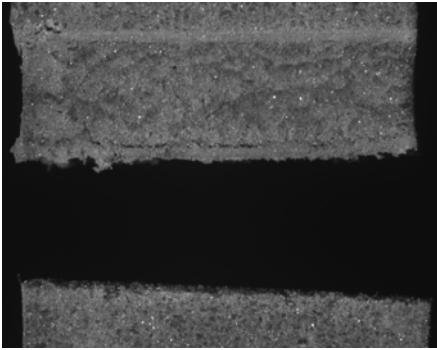


30
min

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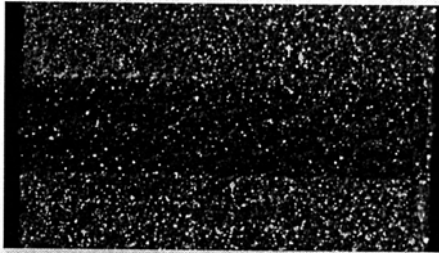
Fracture Surfaces (specimen with strong interfacial strength)



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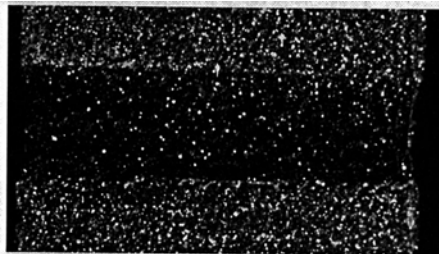
Fracture Surfaces (specimen with weak interfacial strength)



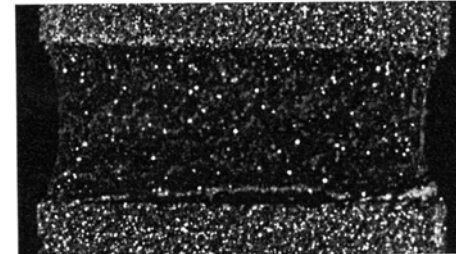
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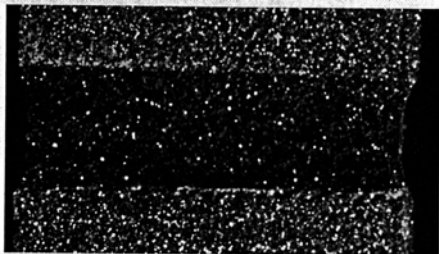
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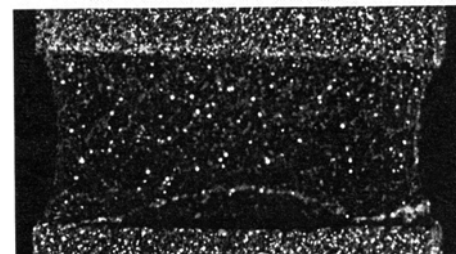
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25
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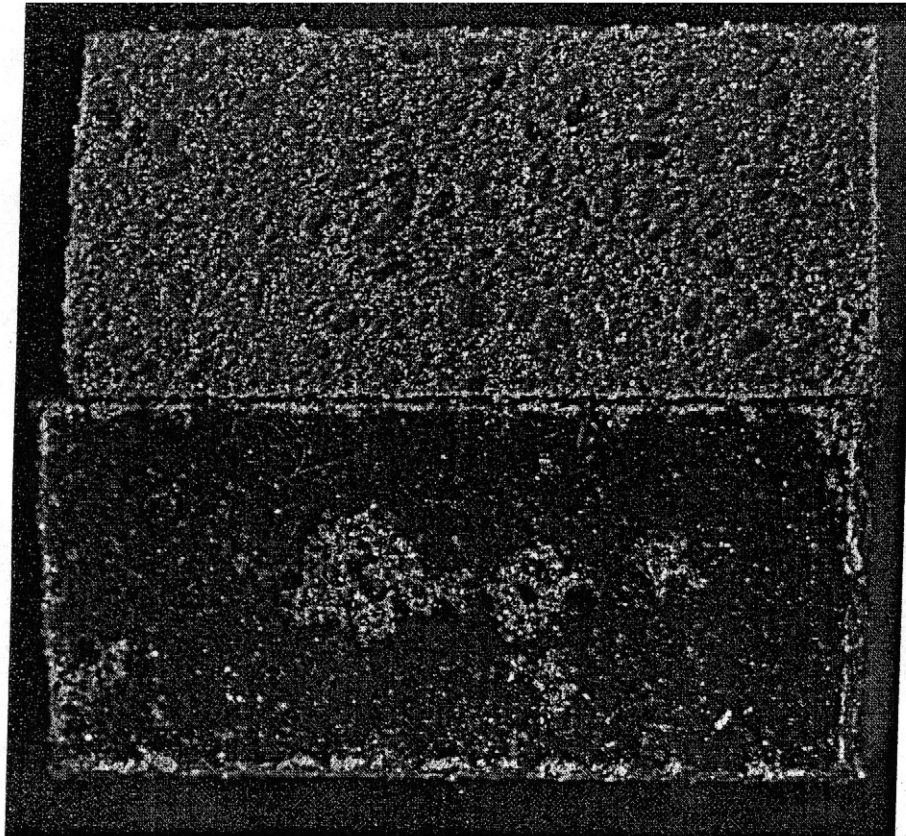
21
min



26
min



Fracture Surfaces (specimen with weak interfacial strength)



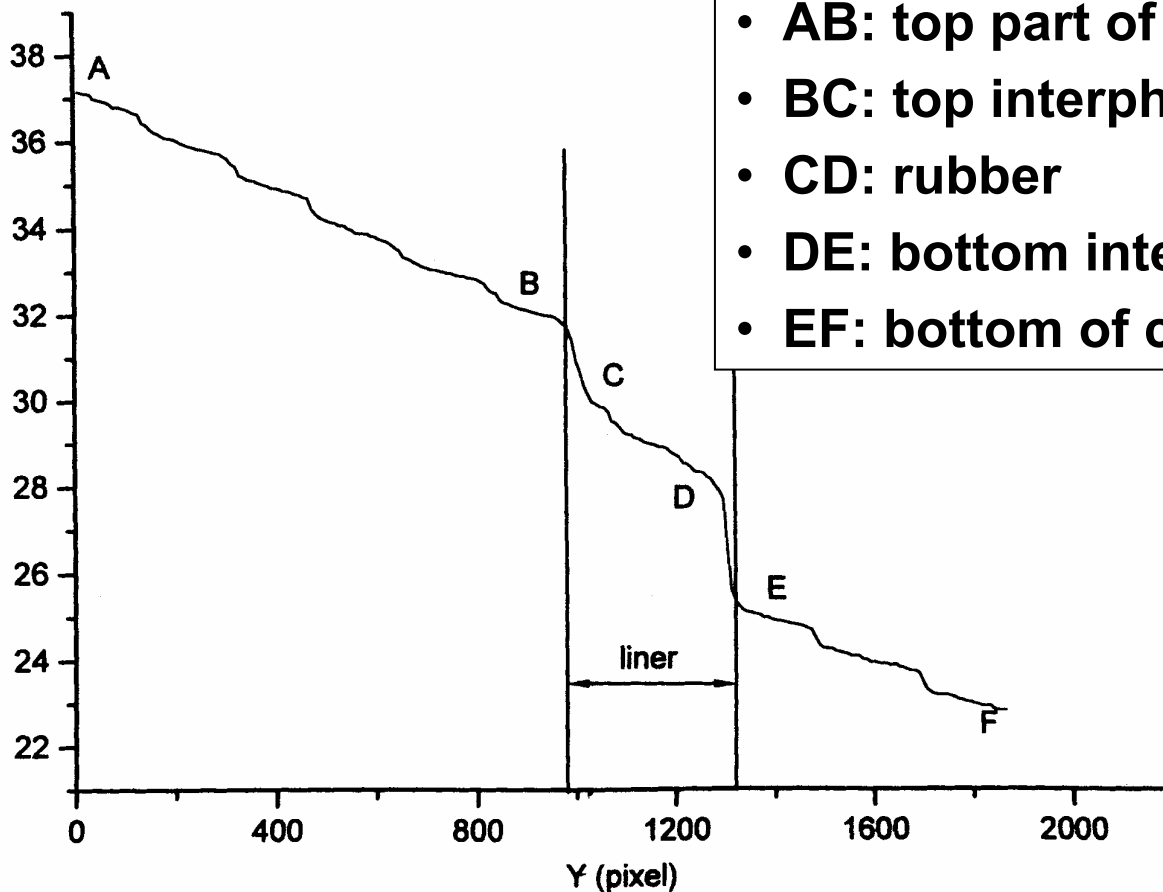
Broken Interface of Specimen V



Displacement Increments Distribution along y Direction



displacement increment between 8 and 10 min
 Δv (pixel)

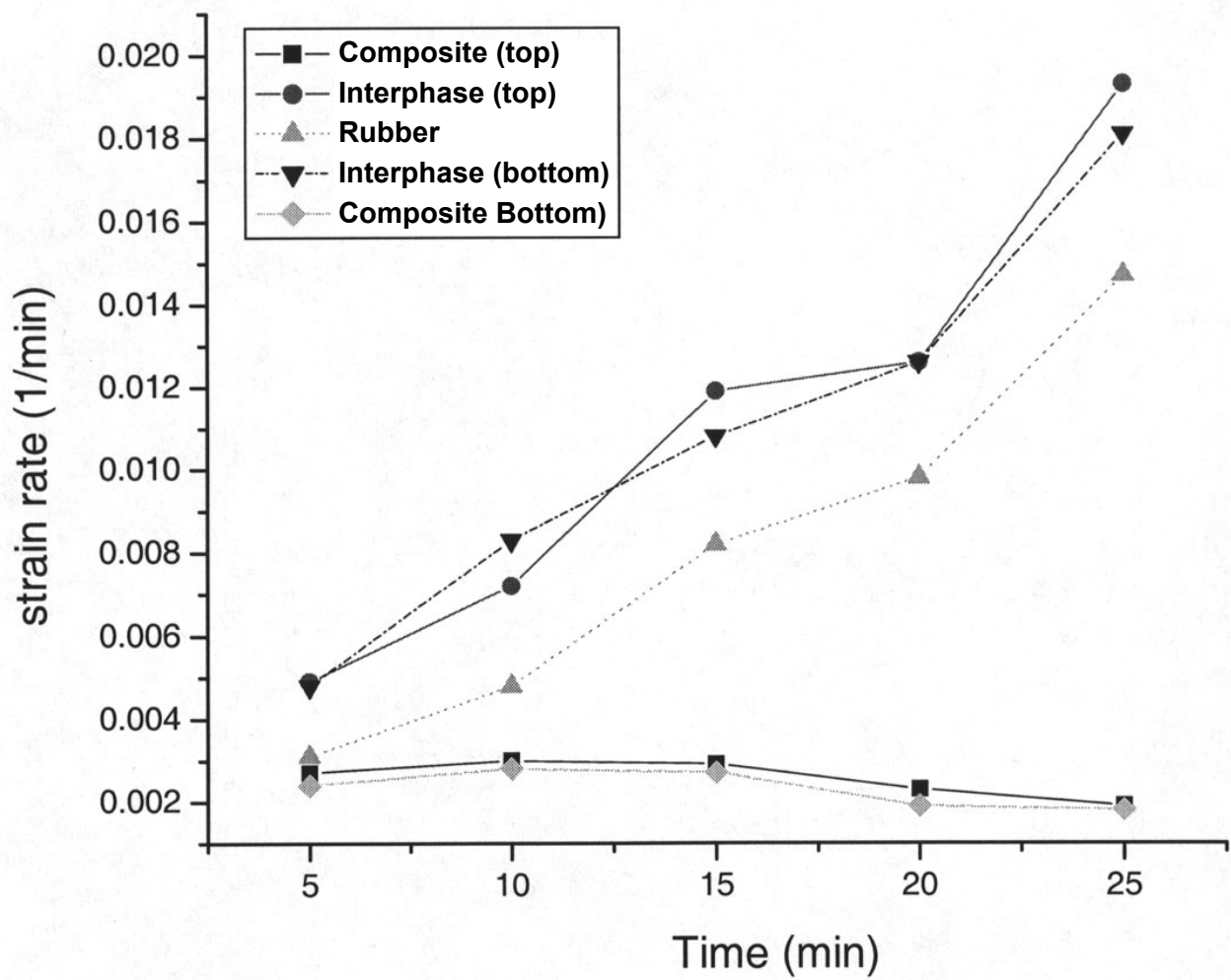


Five sections:

- AB: top part of composite
- BC: top interphase
- CD: rubber
- DE: bottom interphase
- EF: bottom of composite

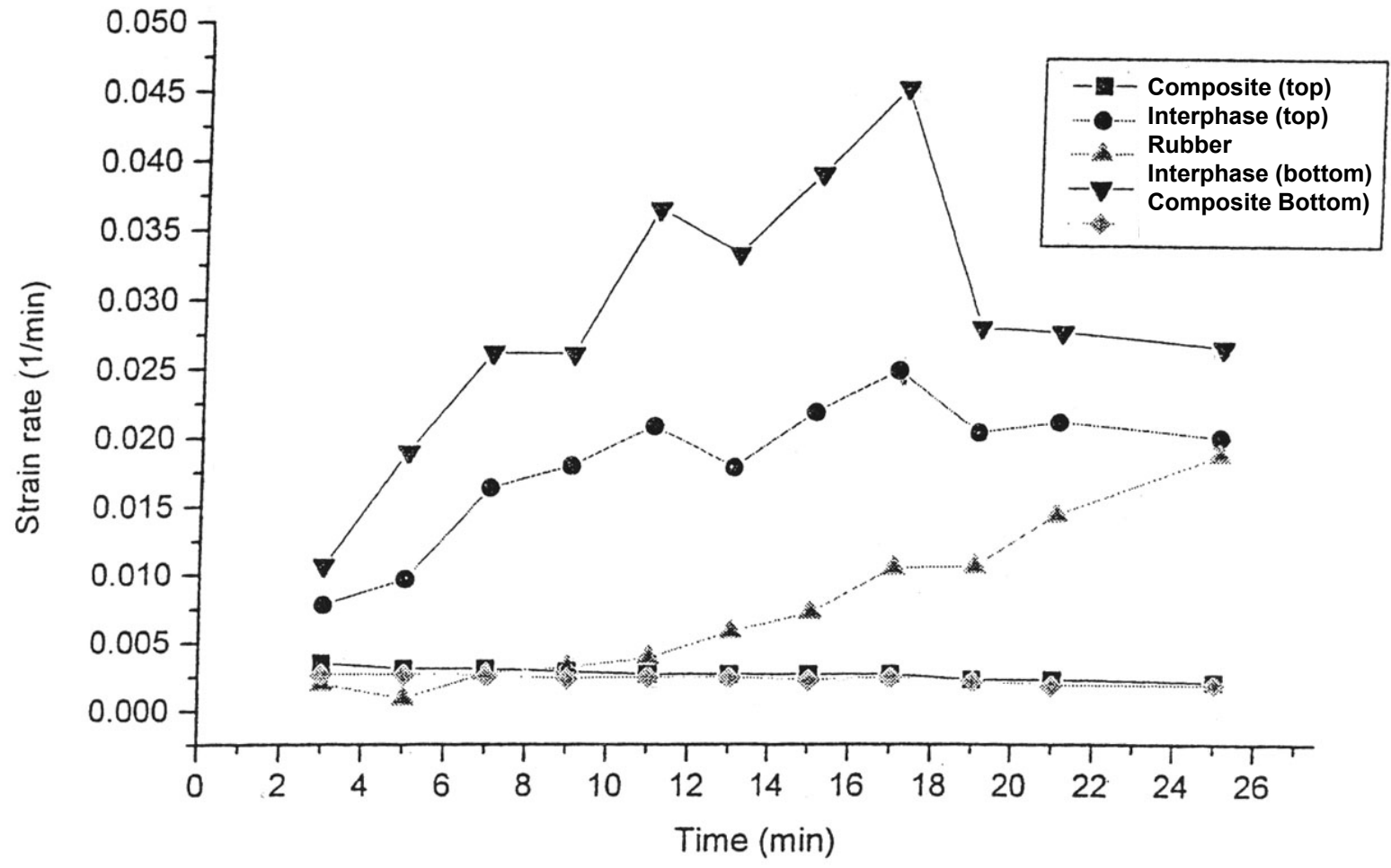


Strain Rate Versus Time Curve (specimen with strong interfacial strength)





Strain Rate Versus Time Curves (specimen with weak interfacial strength)





Conclusions:

- * For the specimen with weak interfacial strength, failure occurs in the interface.**
- For the specimen with strong interfacial strength, failure occurs in the composite layer.**
- There are interphase regions near the interfaces of the specimen.**
- The strain rates in the rubber layer, the composite layers, and the interphase regions change with time.**
- The strain rates in the interphase regions are significantly higher than that in the rubber and the composite layers.**
- The strain rates in the interphase regions decrease as the interfacial strength increases.**

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