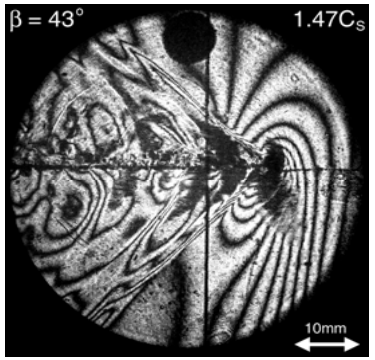
Intersonic Shear Crack Growth in Bonded Structures

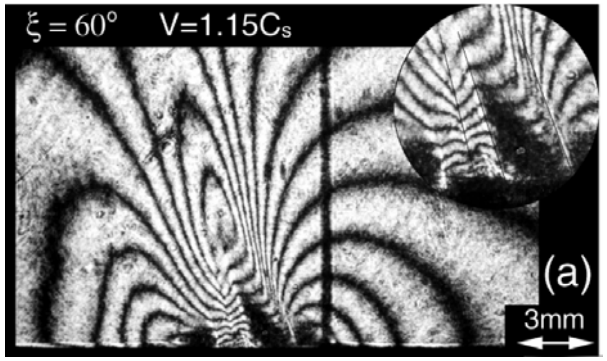
Ares Rosakis

Objectives:

- Study shear-dominated dynamic crack growth, first along a single weak interface in model specimens, then parallel to fiber direction in actual composites. Experimentally visualize stress fields using photoelasticity and high speed photography.



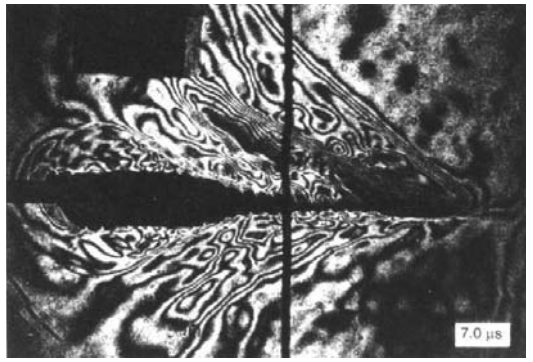
Homalite/homalite



Homalite/steel

Significant Finding:

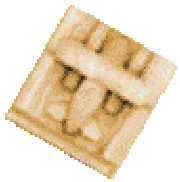
- Observations of shear-dominated crack growth at speeds between the shear wave and longitudinal wave speeds. (Note the Mach cone-like structures in the interferograms).



Composite

Payoffs:

- Revelation of new failure mechanisms in composites that had neither been observed experimentally nor predicted theoretically.
- Awareness of new class of failure criteria for the safe design of composite structures



INTERSONIC CRACK WITH DETACHED CONTACT ZONE ALONG A POLYMER / METAL INTERFACE

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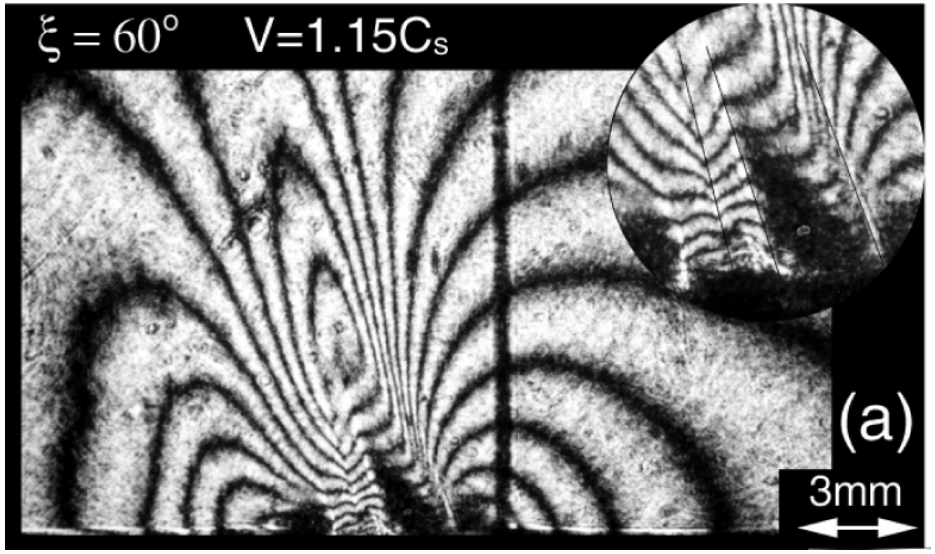
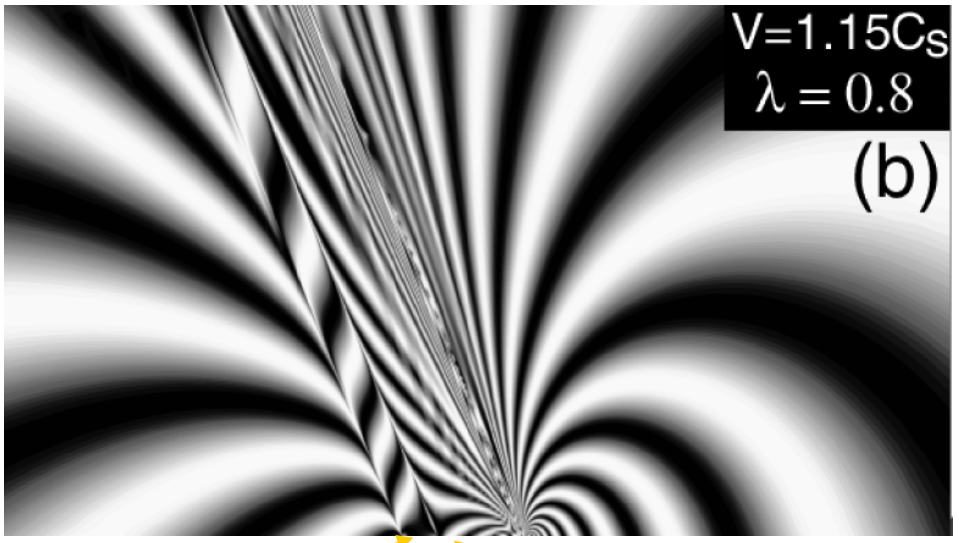
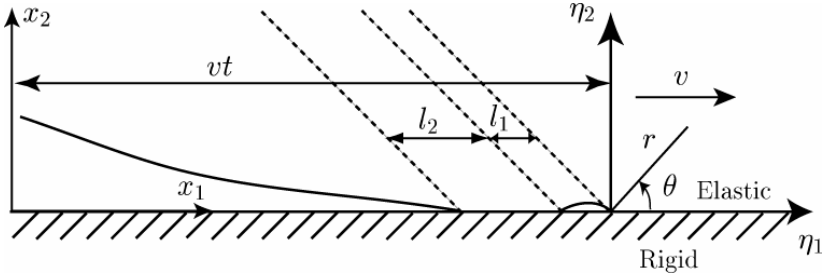


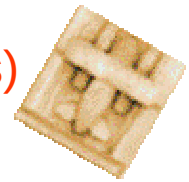


Frictional Contact

"Soft" material, moves away from bond (fault)



- Multiple contact visible by three shear shock waves
- Comparison between experiment and analysis (model by Huang and Rosakis)
- Intersonic shear rupture model includes contact and friction



Interface/Damage Interaction In Layered and Sandwich Structures Subjected to Impact

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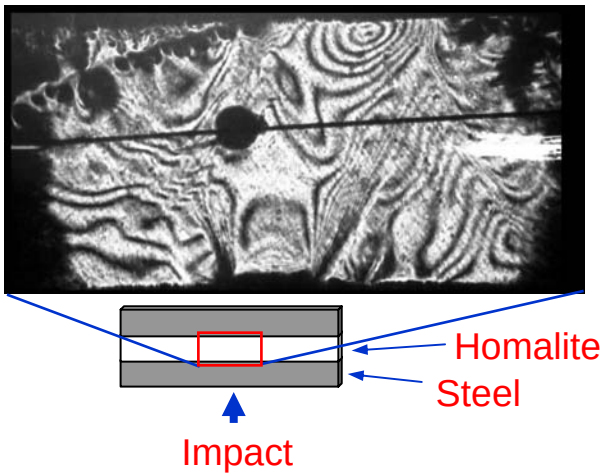
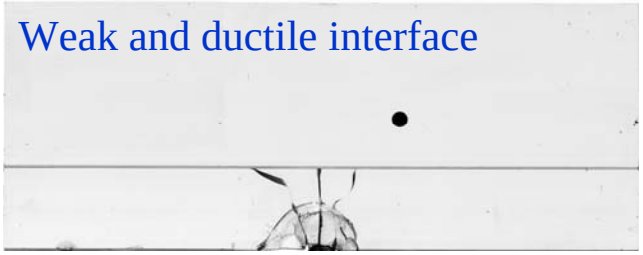
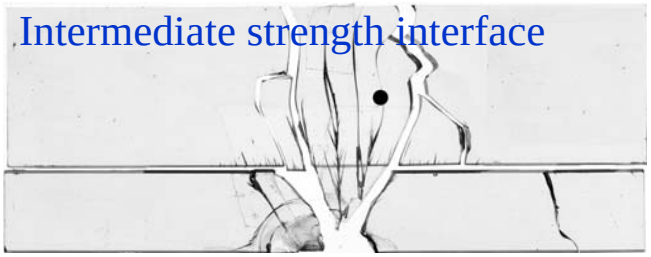
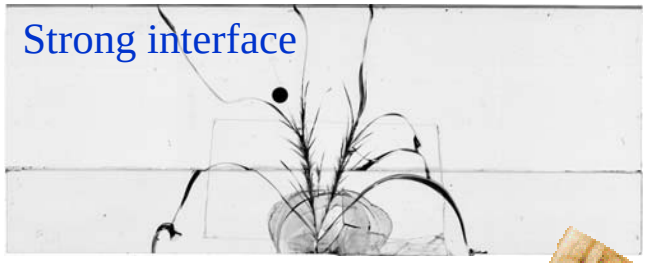


Objectives:

- Study the effect of interface strength and sandwich structure geometry on damage due to transverse impact. Photoelasticity and high speed photography is used to determine the *sequence* of events.







Significant Finding:

- Weaker interfaces reduce the amount of damage propagated to subsequent layers.
- Mismatch in material wave speeds cause intersonic shear cracks followed by intra-layer damage.

Payoffs:

- Benchmark results for computational model validation.
- Improved design of sandwich structures, hybrid joints, armor plate, etc.