

EFFECTIVE MODELING OF COMPOSITE RAILROAD TIE IN REVENUE SERVICE



DETERMINING MOE AND MOR



3 PT. BEND USED TO MODULUS OR ELASTICITY (MOE) AND MODULUS OF RUPTURE (MOR)

DYNAMIC TESTING

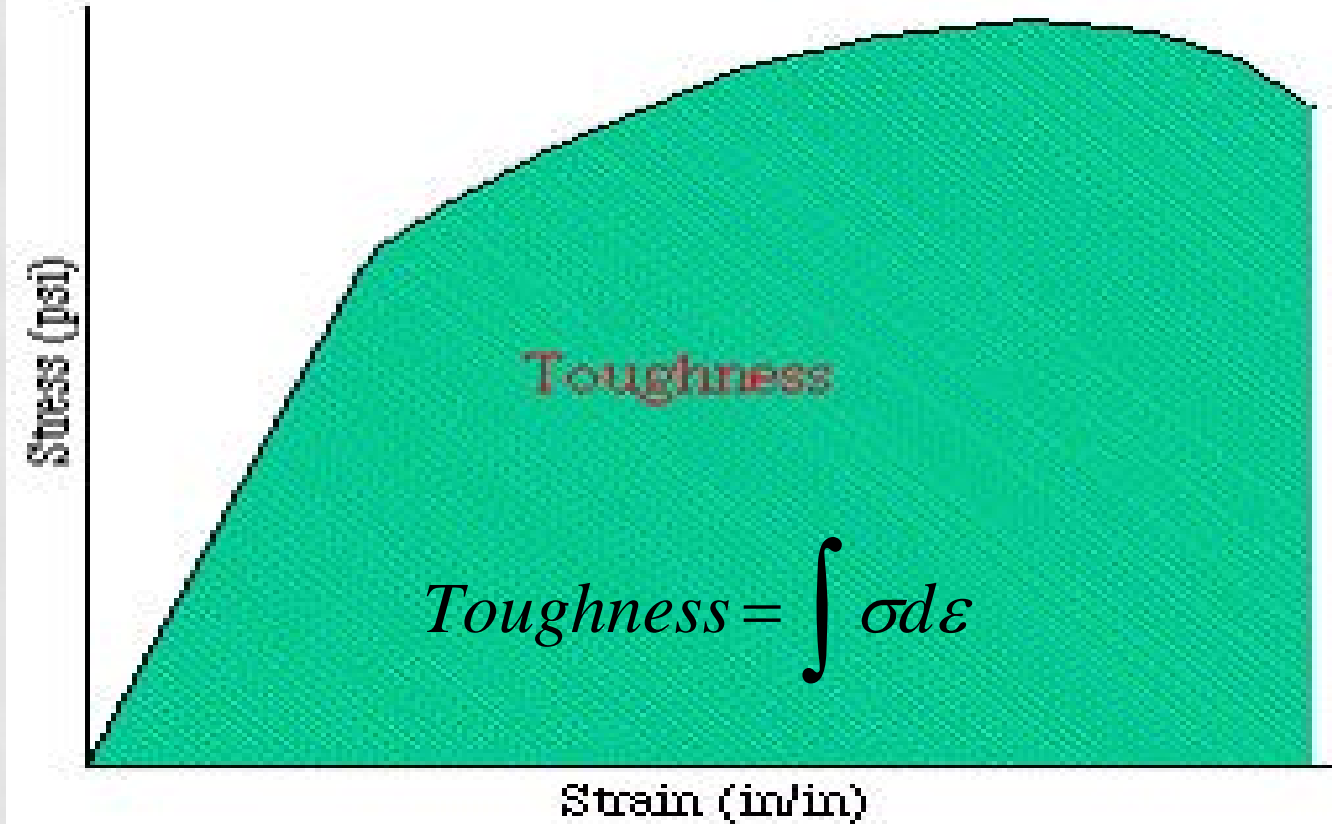
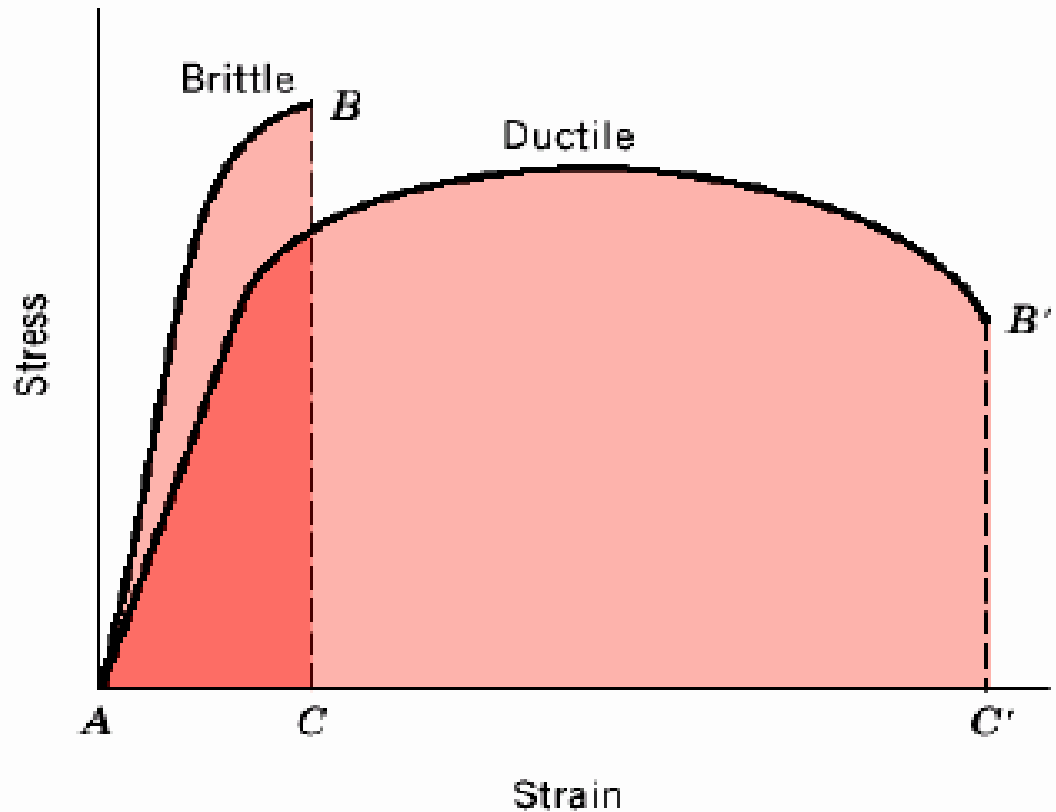


- Fatigue Testing TICI



- Fatigue Testing
University of Munich

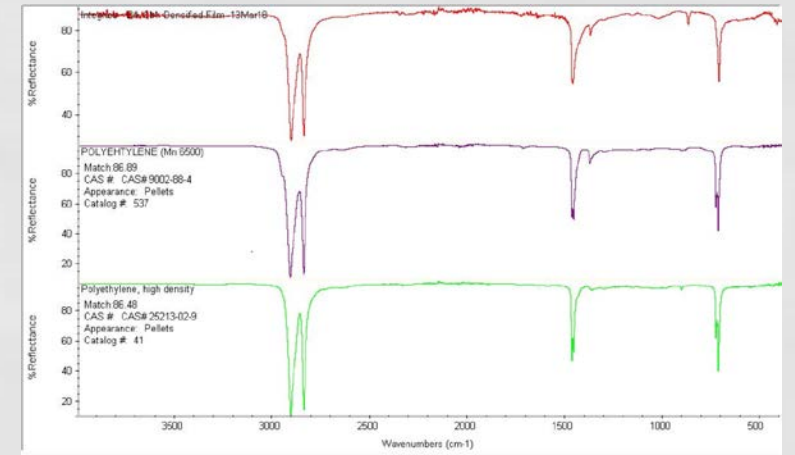
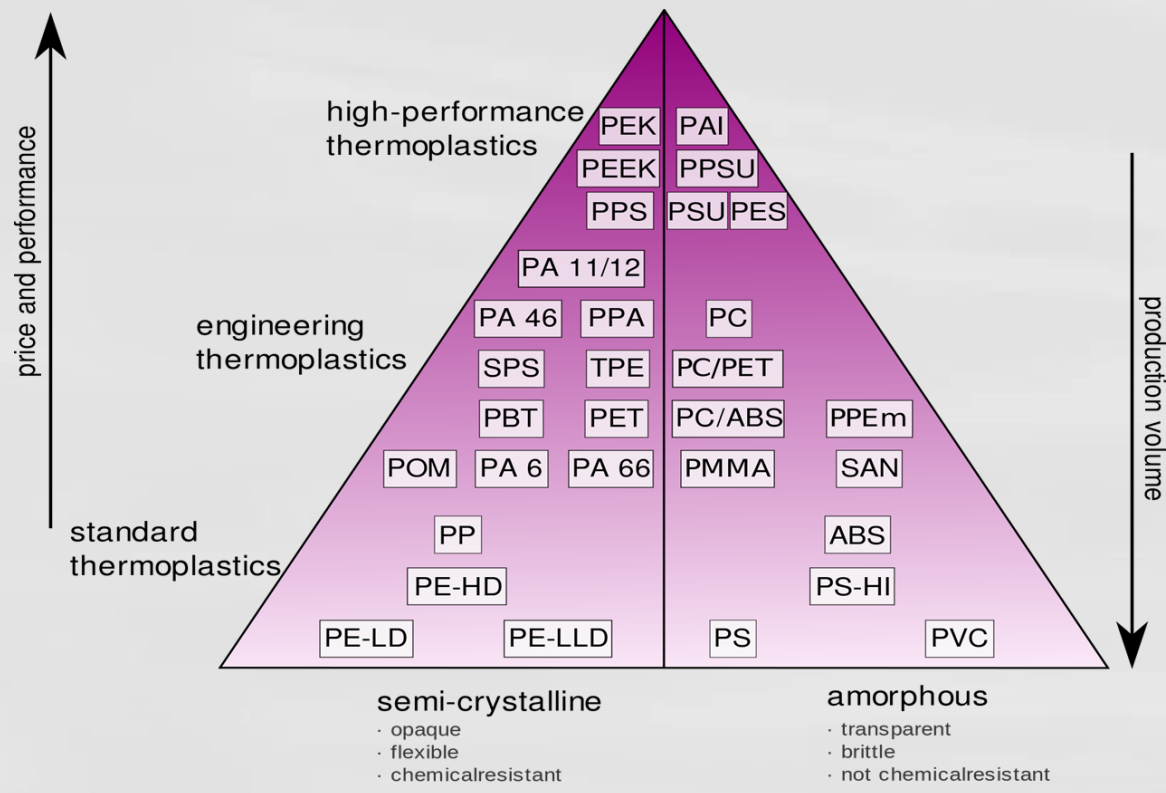
MEASURED STRENGTH & TOUGHNESS OF PLASTIC



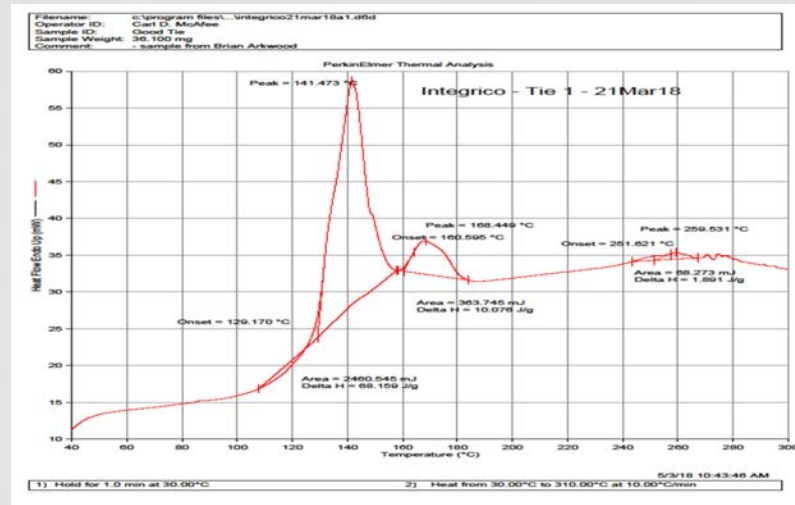
- **Strength** is resistance to plastic flow and thus is related to the stress required to move dislocations through the solid.
- **Toughness** is the resistance of a material to the *propagation* of a crack.

POLYMER CHARACTERIZATION

FTIR – Chemical Fingerprint



DSC – Thermal Characterization



- CONSISTENCY
- AVAILABILITY
- PROCESSABILITY
- COST

TESTING THE COMPOSITE TIE

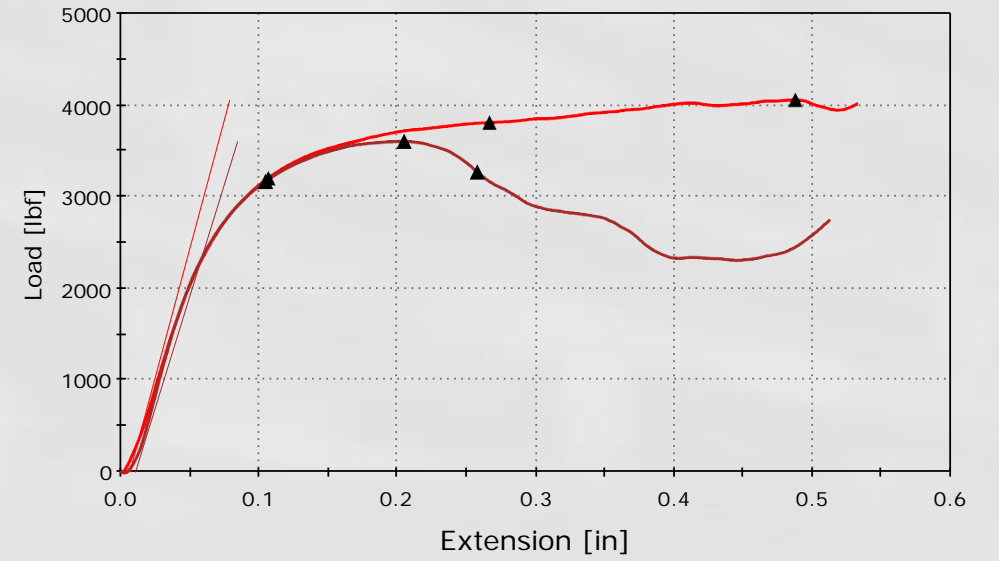
SAMPLE AREAS



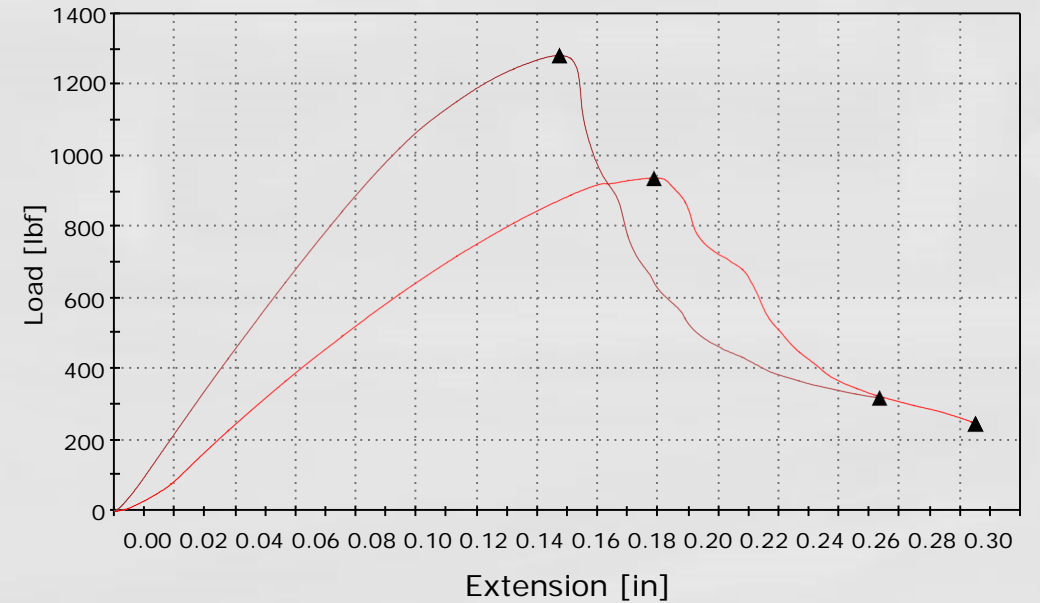
TEST SAMPLES



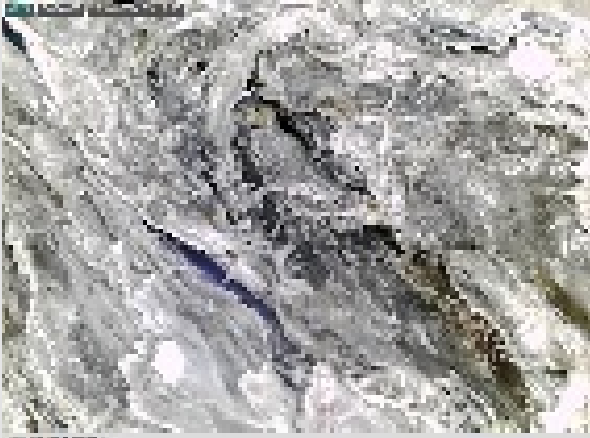
COMPRESSION TEST



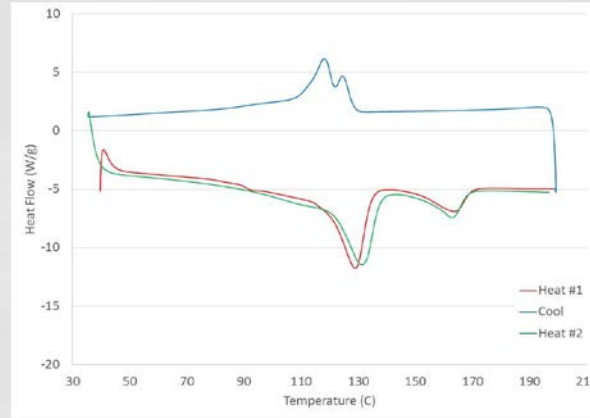
FLEXURAL TEST



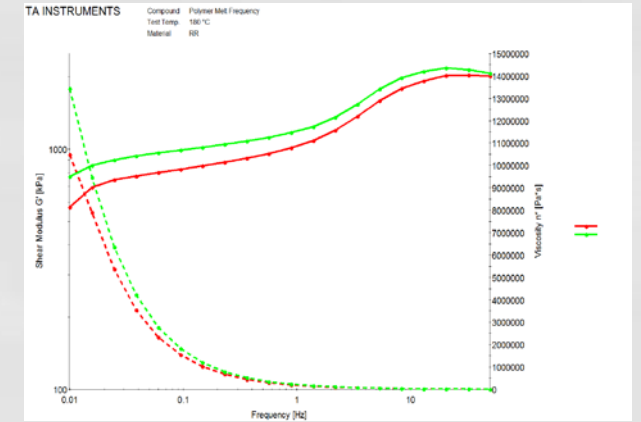
POLYMER CHARACTERIZATION ANALYSIS



● DUCTILE FAILURE



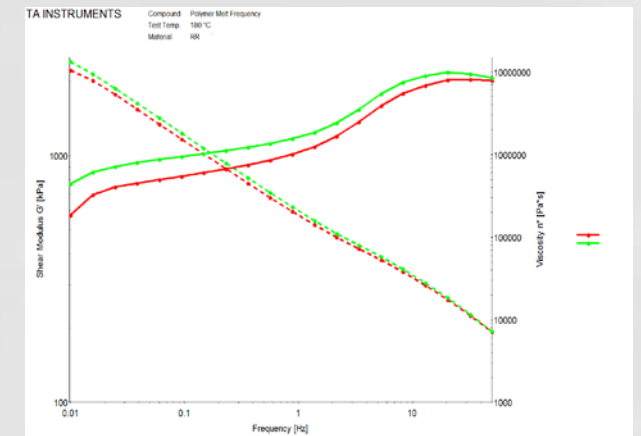
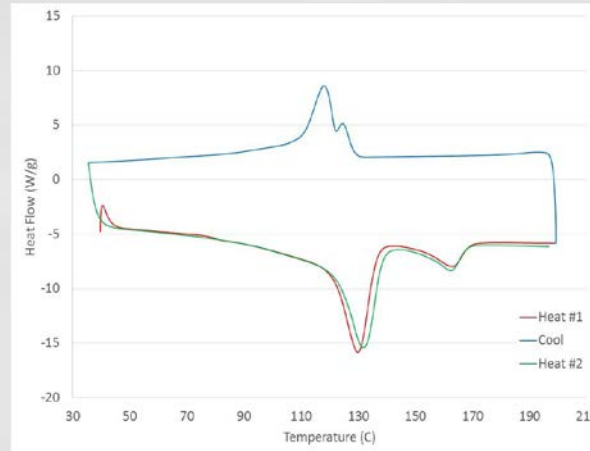
● DSC ANALYSIS



● RHEOLOGY










● BRITTLE FAILURE



STATUS – NEXT STEPS

- PROPER POLYMER CHARACTERIZATION CAN PREDICT PERFORMANCE – STRENGTH AND TOUGHNESS
- ADDITIONAL DATA COLLECTION IN SERVICE TO BETTER DEFINE REQUIREMENTS IN LAB MODELS
- LIFE CYCLE ESTIMATION MODEL

PLASTIC RESIN CODES						
						
PETE	HDPE	V	LDPE	PP	PS	OTHER
Polyethylene Terephthalate soda bottles water bottles shampoo bottles mouthwash bottles peanut butter jars	High Density Polyethylene milk, water and juice jugs detergent bottles yogurt and margarine tubs grocery bags	Vinyl clear food packaging shampoo bottles	Low Density Polyethylene bread bags frozen food bags squeezeable bottles (mustard, honey)	Polypropylene ketchup bottles yogurt and margarine tubs	Polystyrene meat trays egg cartons cups and plates	Other ketchup 3 & 5 gallon water bottles some juice bottles



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