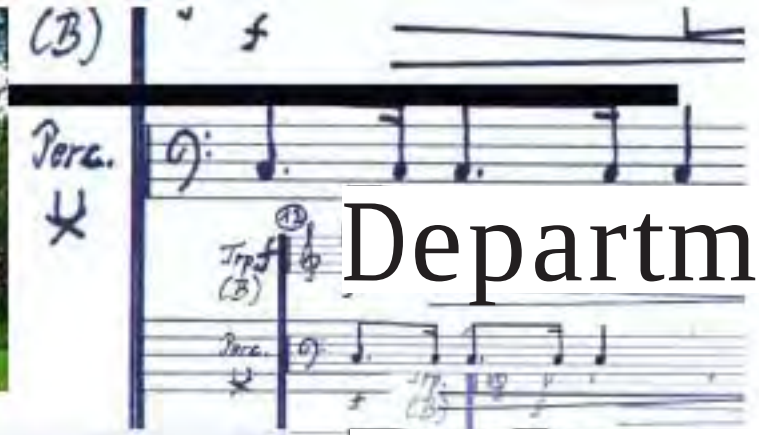


Department of Polymer Engineering

Thermosetting Composites

EQUIPMENT

Curing

(30 x 30 x 40 cm^3)

1 or 2 Components Injection system

RTM

Convection Ovens

(75 x 75 x 100 cm^3)

Autoclave

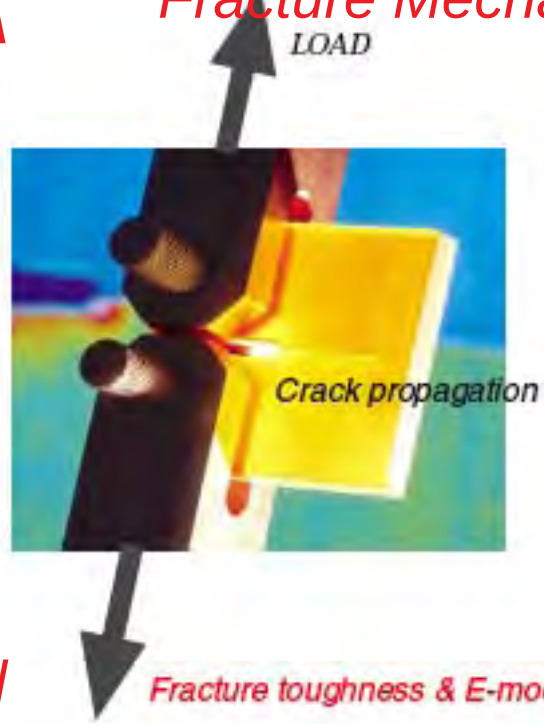
EQUIPMENT

Characterization of resins

MDSC

DMA

Fracture Mechanics



Rheometer

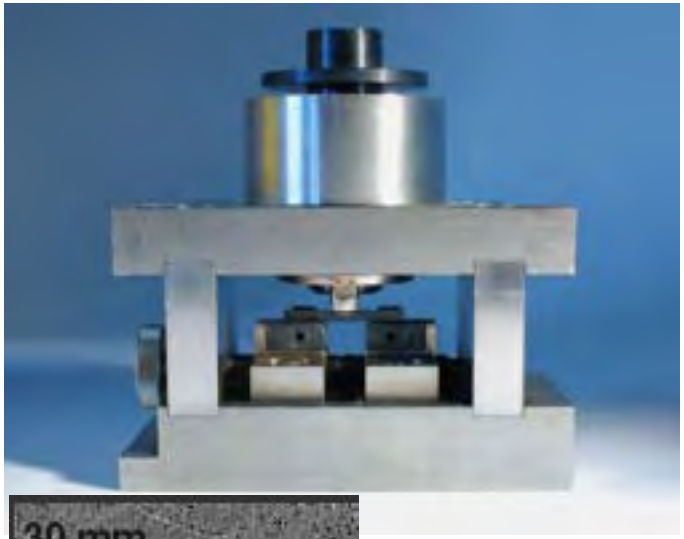
Mechanical Testing

FT-IR

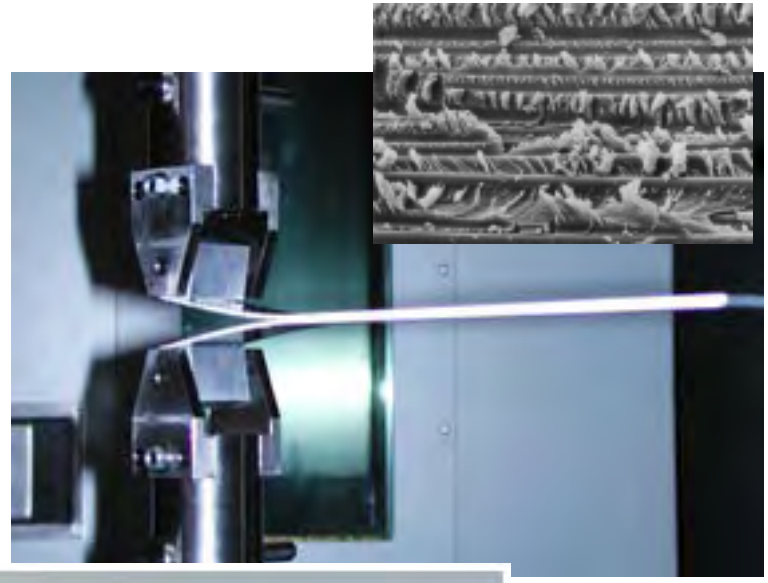
EQUIPMENT

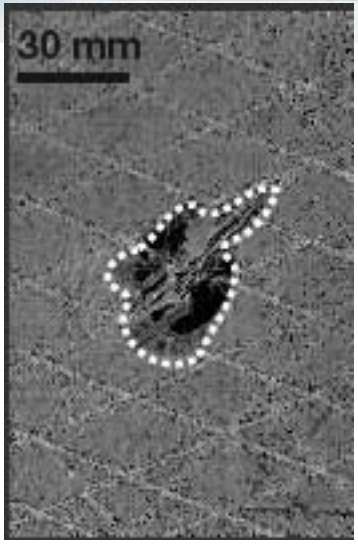
Composite Testing

Quasi-Static



Fracture Mechanics





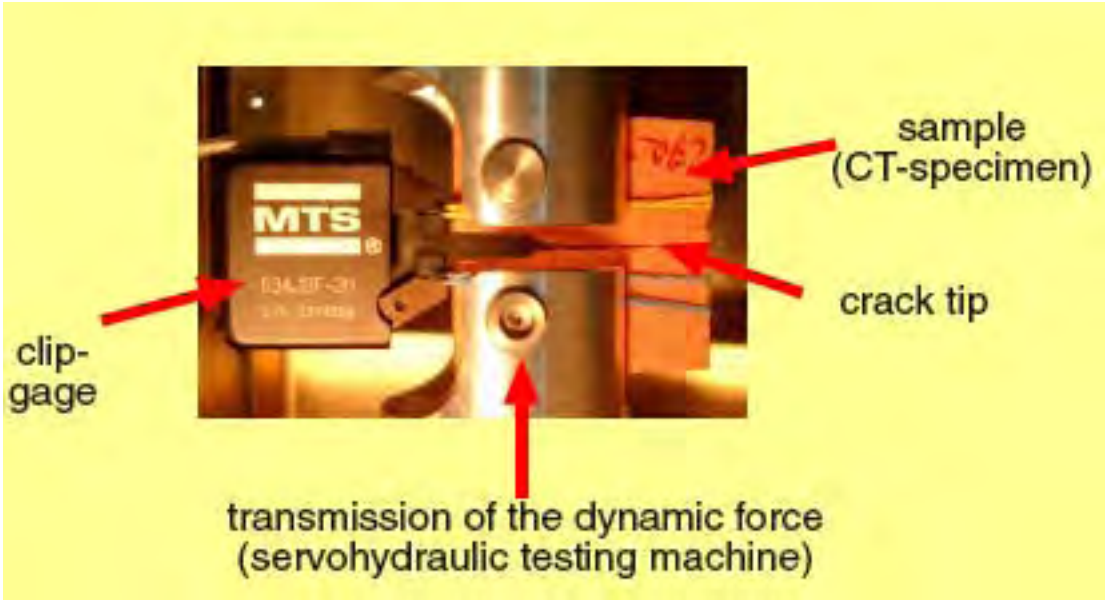
Impact & Ultrasound

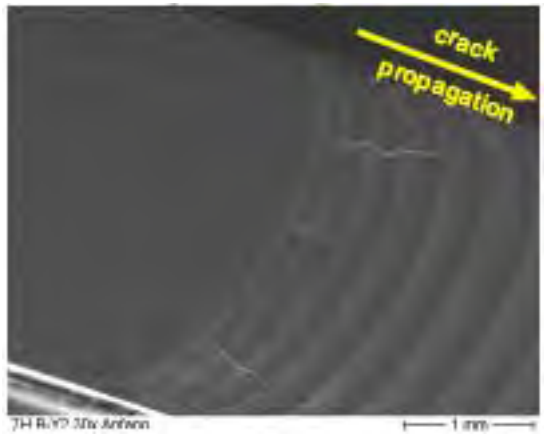
Compression after impact

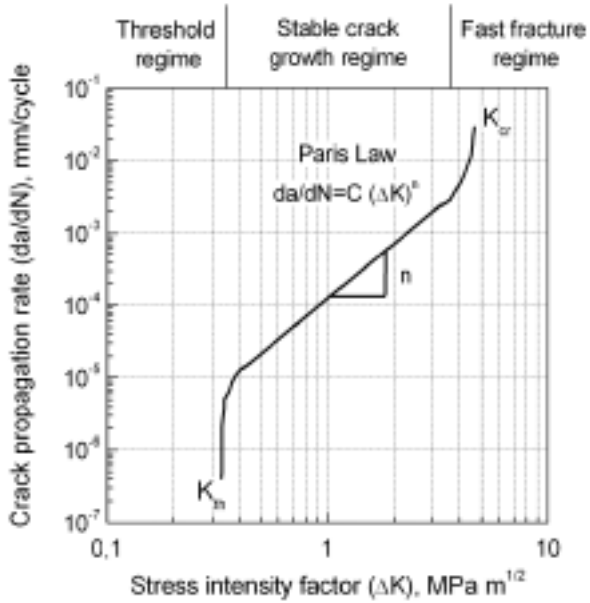
EQUIPMENT

Cyclic loading - Fatigue crack growth (da/dN)

Evaluation of crack growth under dynamic load



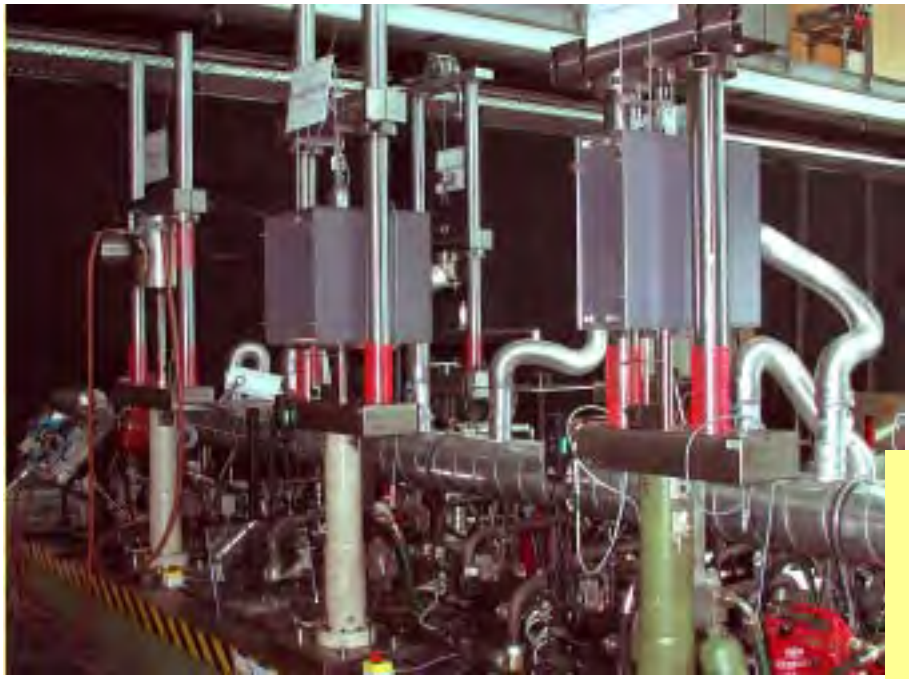




EQUIPMENT

Cyclic loading - Fatigue of Composites

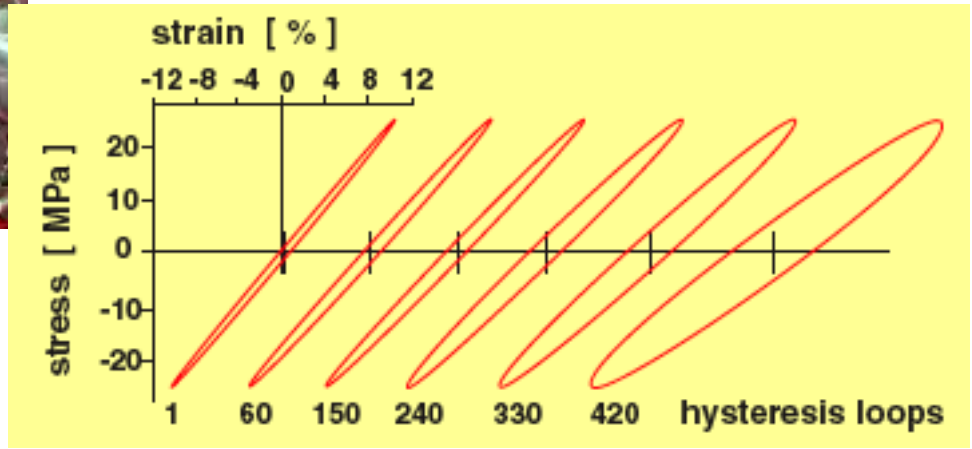
Hysteresis Measurements



Servo-hydraulic Test Machines

Testing of Composite Bycicle Seat

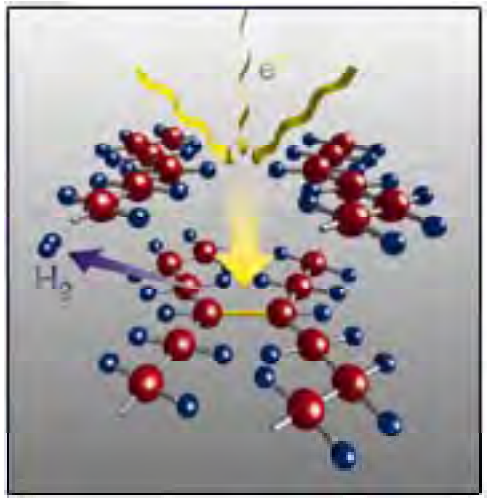
Hysteresis Loops

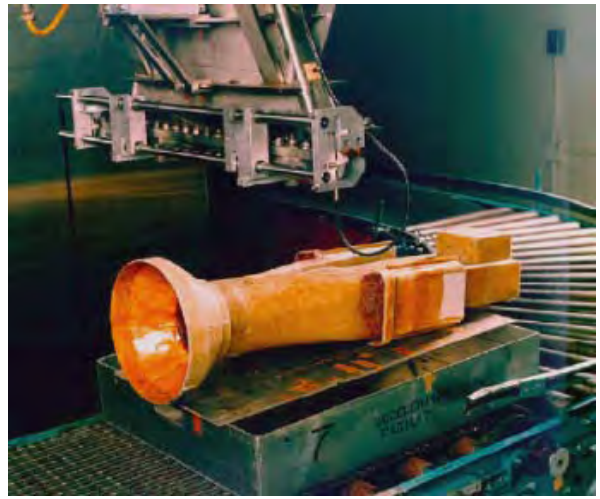


Main Research Fields

- *Fast Curing Resins*
- *Resin Modification*
- *Flame Retardancy*
- *Stitched Preforms*

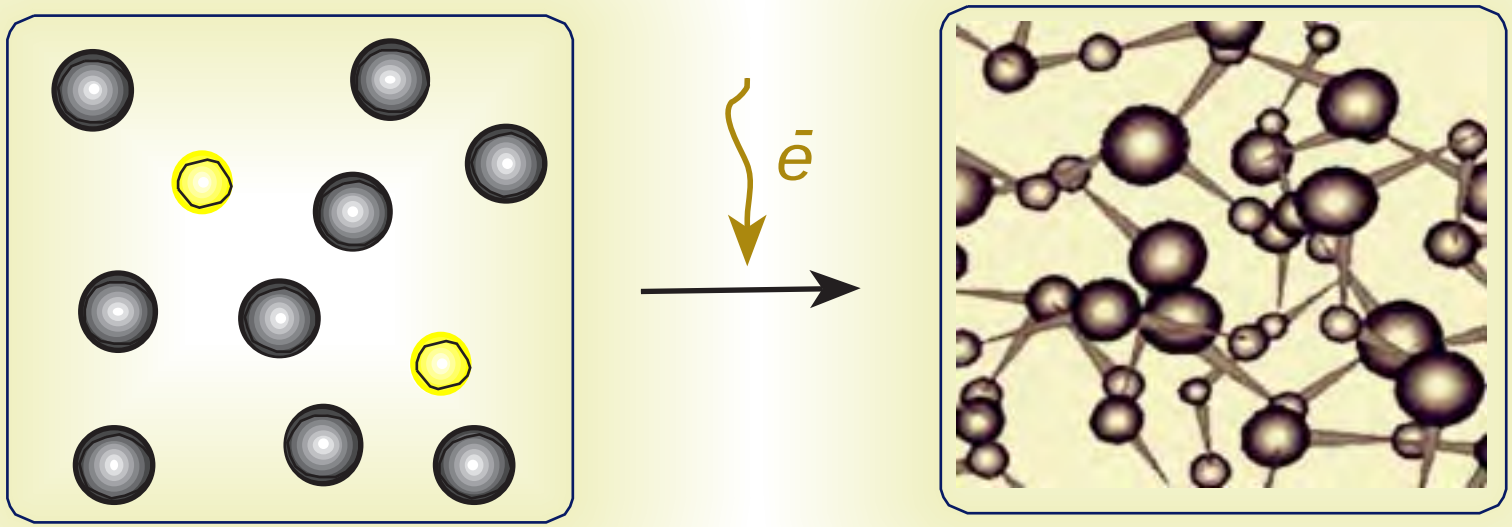
Electron Beam Curable Epoxy Resins





Electron Beam Curing of Composites

- *IN LINE PRODUCTION*
  - *ROOM TEMPERATURE PROCESS*
    - *CURING OF COMPOSITES IN MINUTES*



Resin + Initiator

Crosslinked network

ENGINEERING POLYMER

University of Bayreuth

Innovative Resins for Rotor Blades in Wind Energy

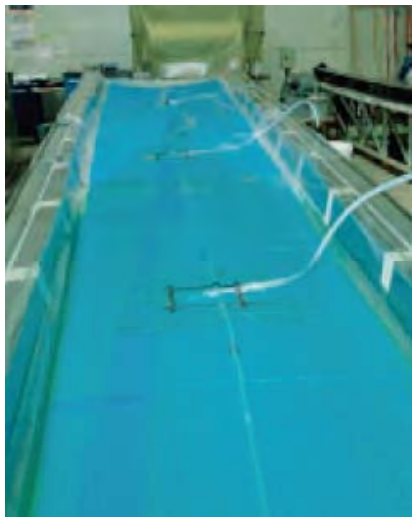
Innovative Resins for Rotor Blades

Current manufacturing method: Infusion process.

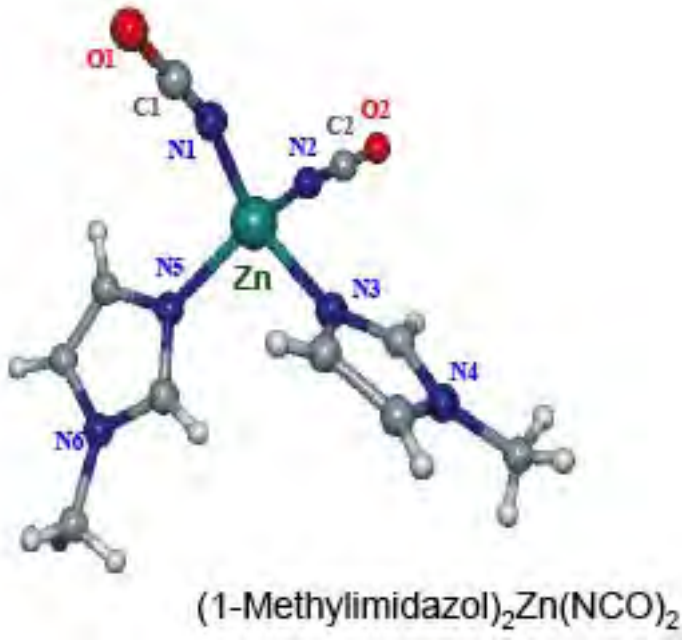
Curing Cycle: approximately 24 h at 70°C

Objective: Development of fast curing resin systems for infusion, with equivalent or better mechanical behaviour

Infusion process



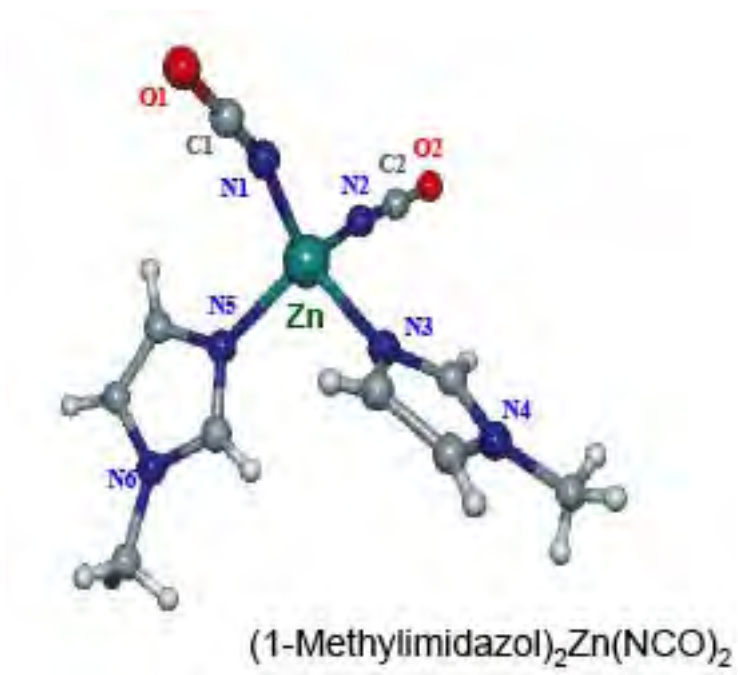
RTM resins systems based on thermal latent catalysts



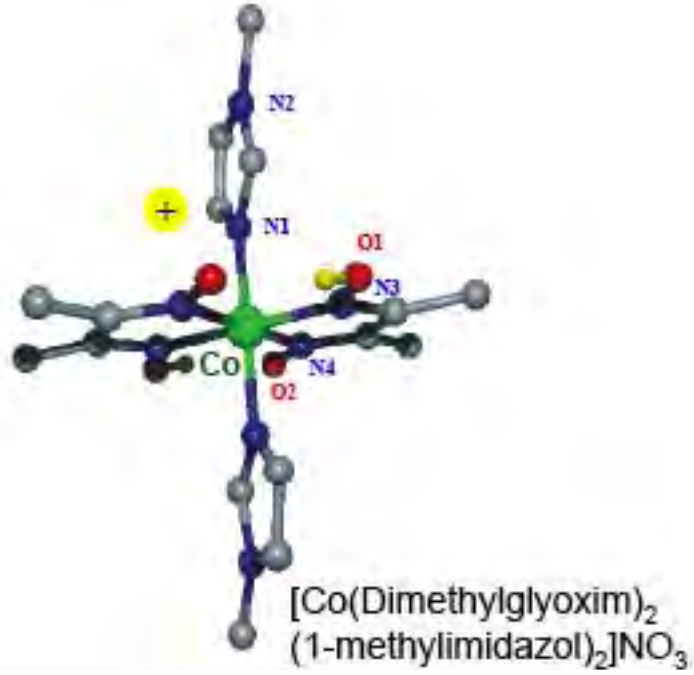
(1-Methylimidazol)$_2$Zn(NCO)$_2$

KAT - resins

Thermal latent metal-organic catalysts for curing of Epoxy



$(1\text{-Methylimidazol})_2Zn(NCO)_2$

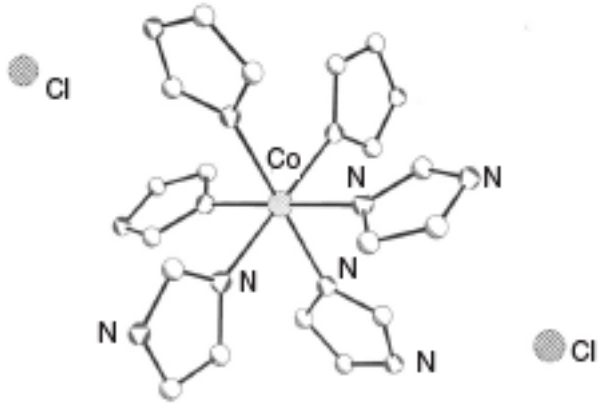


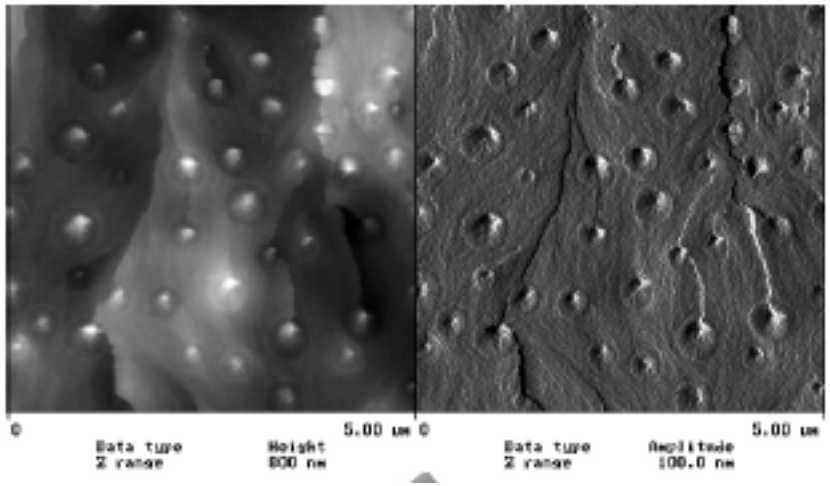
$[Co(Dimethylglyoxim)_2(1\text{-methylimidazol})_2]NO_3$

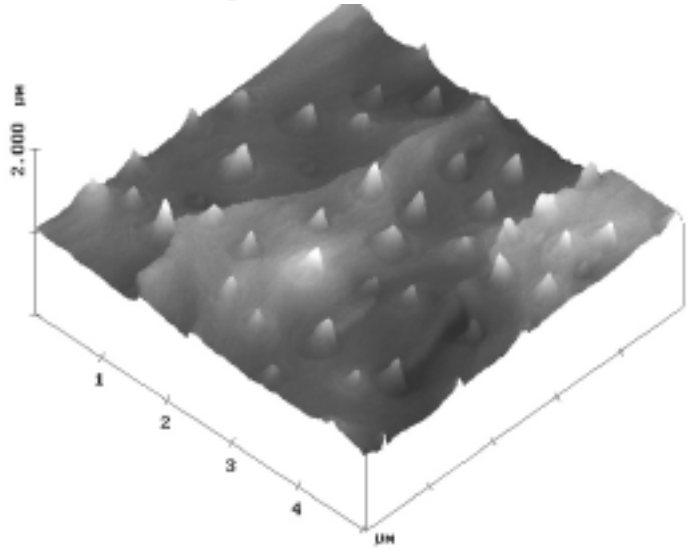
- HIGH REACTIVITY

- THERMAL STABILITY

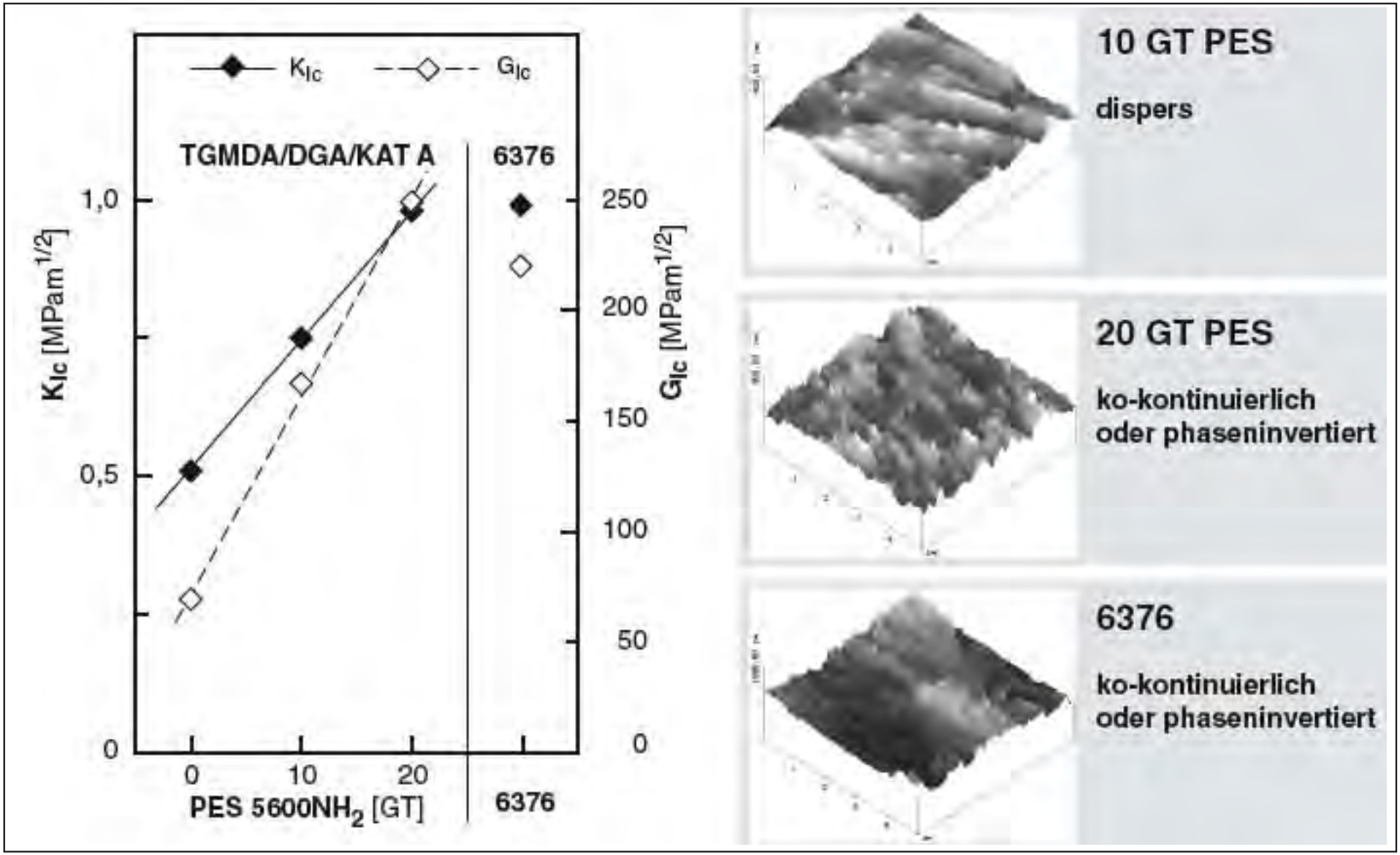
Toughness Modification of KAT-resins





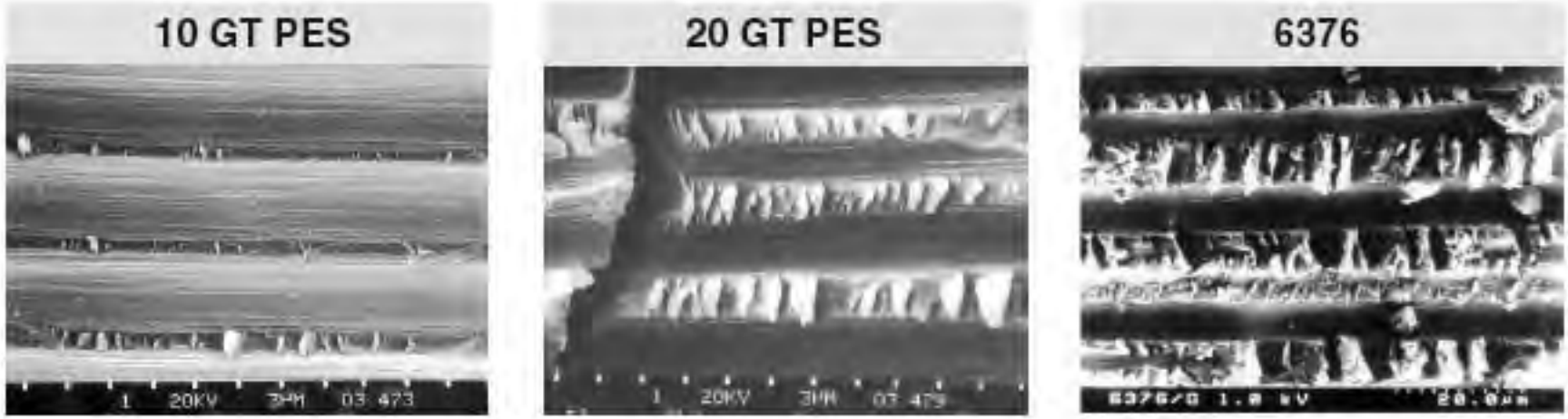


Toughness modification of KAT - resins

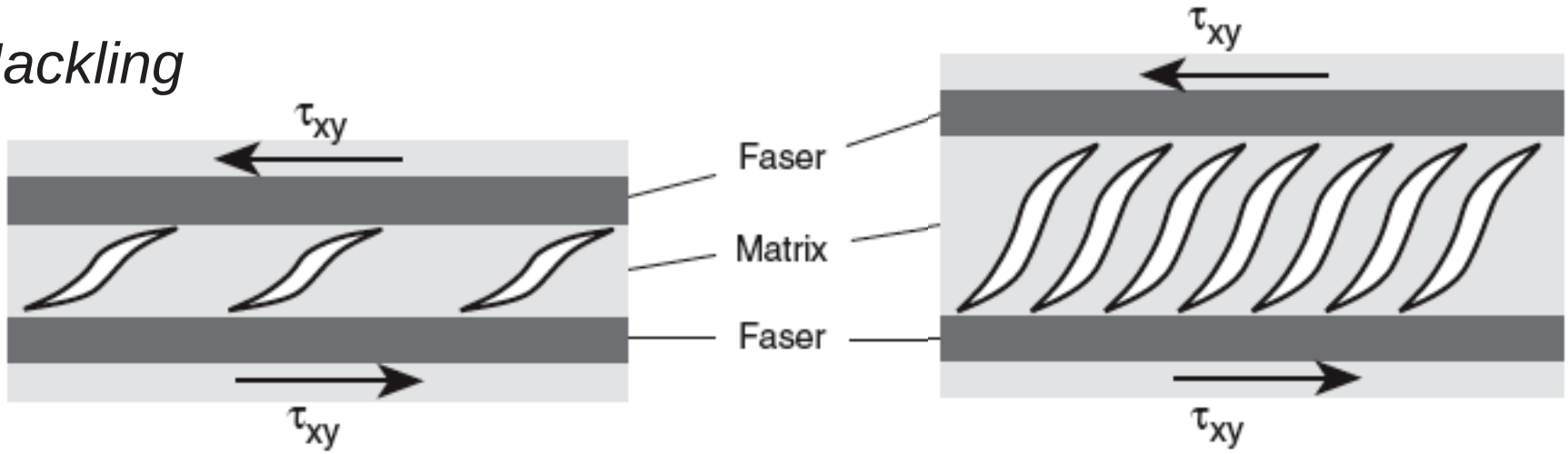


Toughness modification of KAT - resins

Surface of fracture of Composites



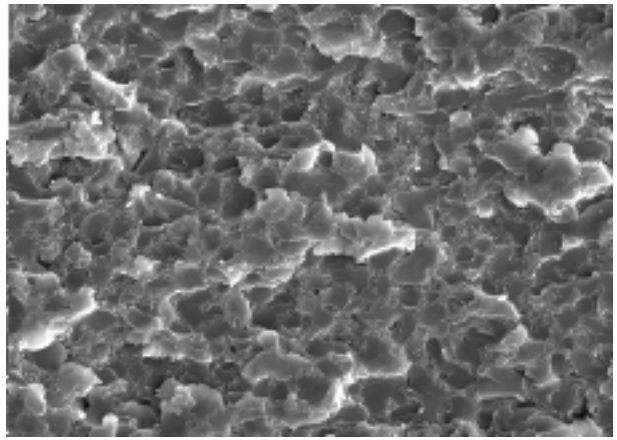
Hackling



ENGINEERING POLYMER

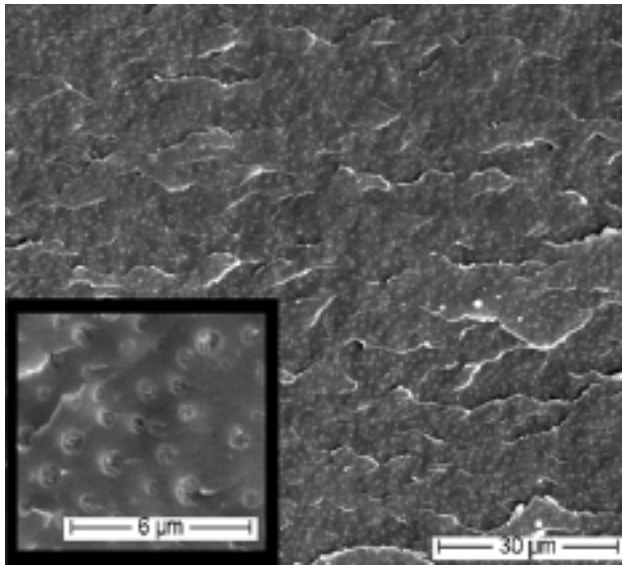
University of Bayreuth

Highly Toughened Epoxy Resins



Matrix Materials for Aerospace Applications

Toughness Modification of Epoxy Resins



Epoxy / Block-Copolymer Blends

High Toughness

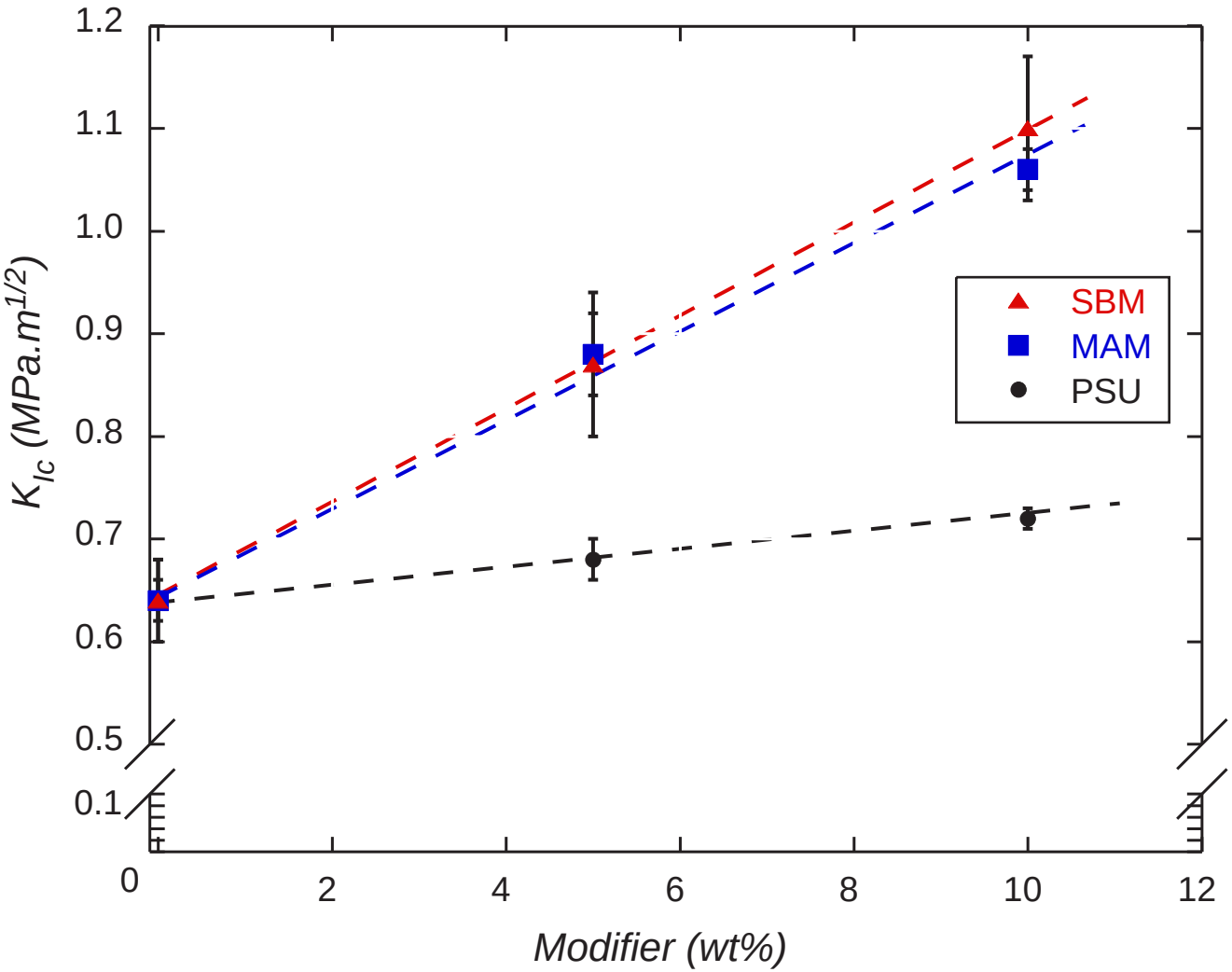
Low Viscosity

High performance Matrix for CFRC

RTM

Toughness Modification of Epoxy Resins

Toughening Effect of Block-Copolymers in RTM6

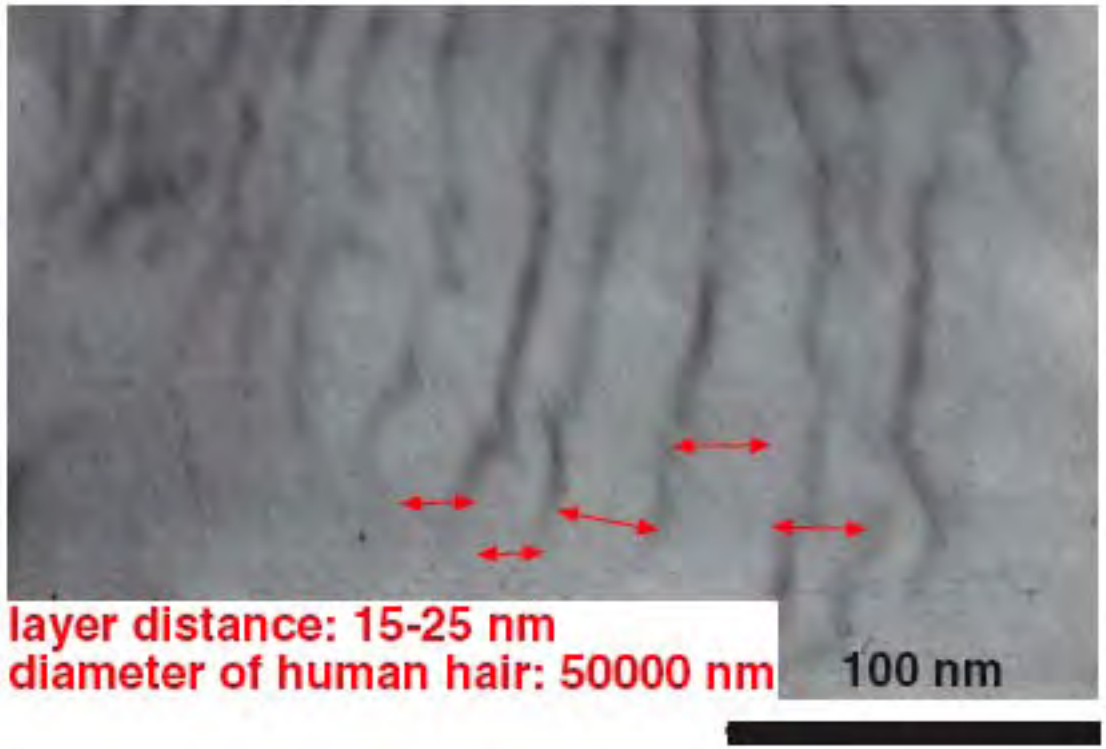


Nanocomposites for High Voltage Insulation

NanoIso

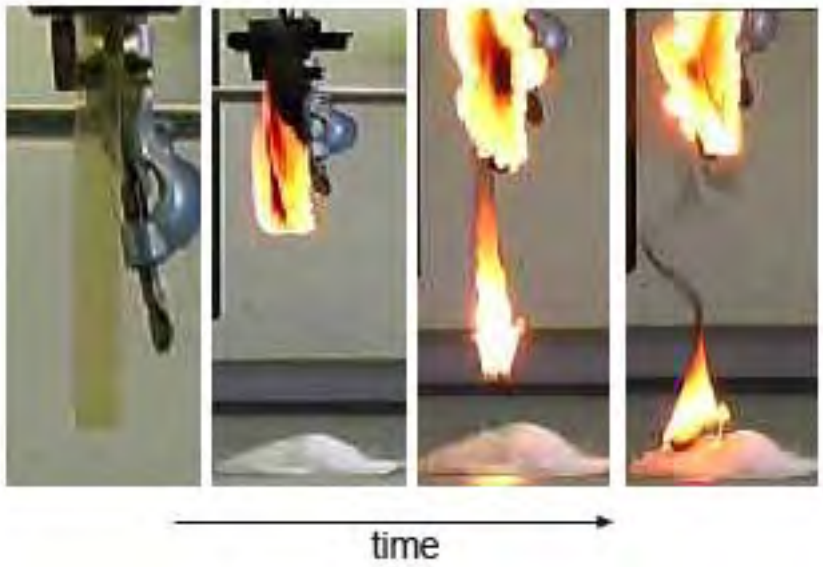
Nanocomposites for Electrical Insulation

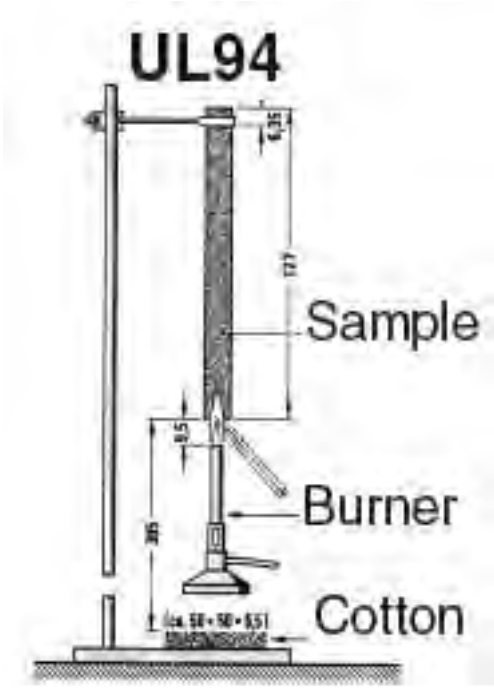
Building a barrier agains harmful discharge by Layered Nanostructures



Novel Insulation Material reinforced with Nanoclays

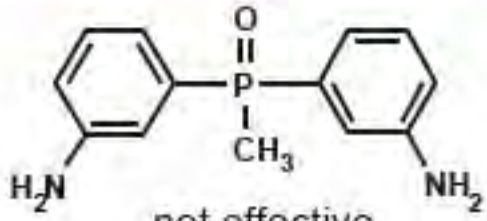
Organophosphorus Flame Retardants



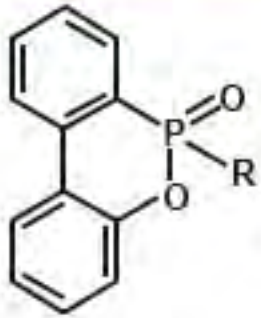


Organo-phosphorus Compounds

- novel flame retardants
  - proofed: effectiveness of phosphorus as flame retardant
  - effective and not-effective chemical structures identified



not effective

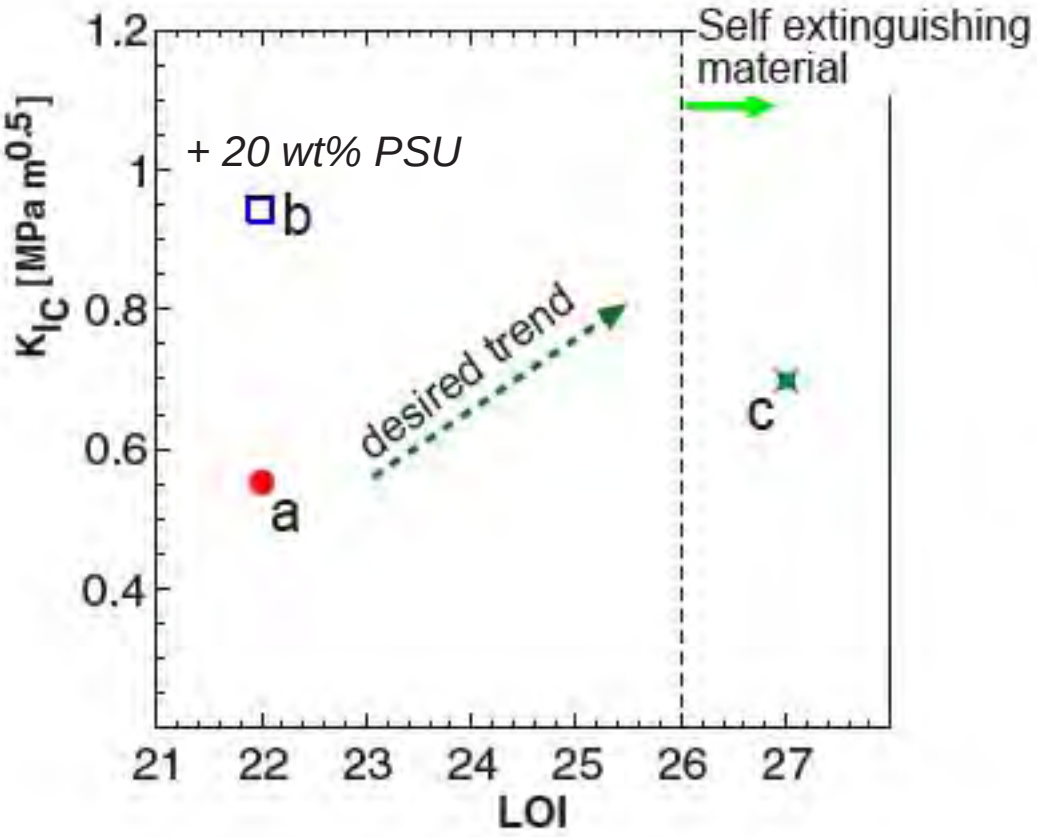


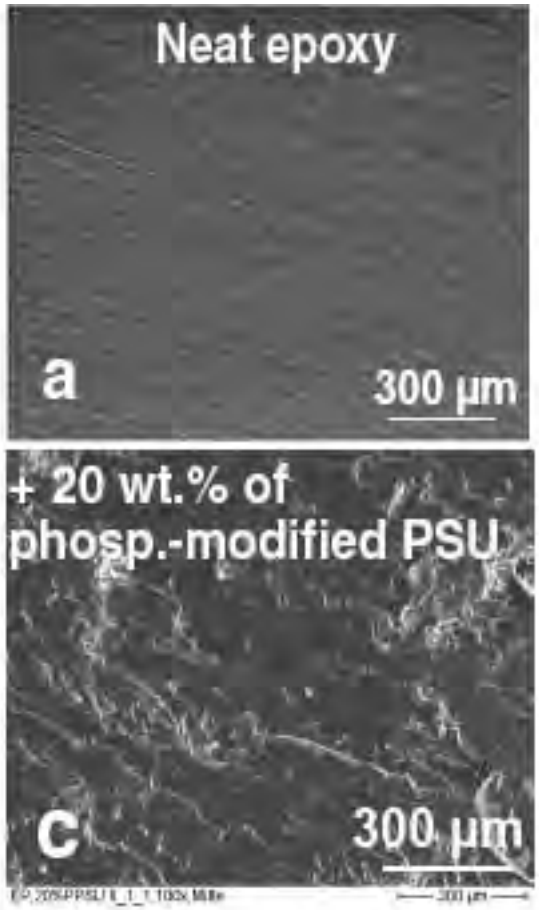
effective

  - extended time to ignition
  - lower formation of smoke and smoke density
  - high T_g
  - modular system possible

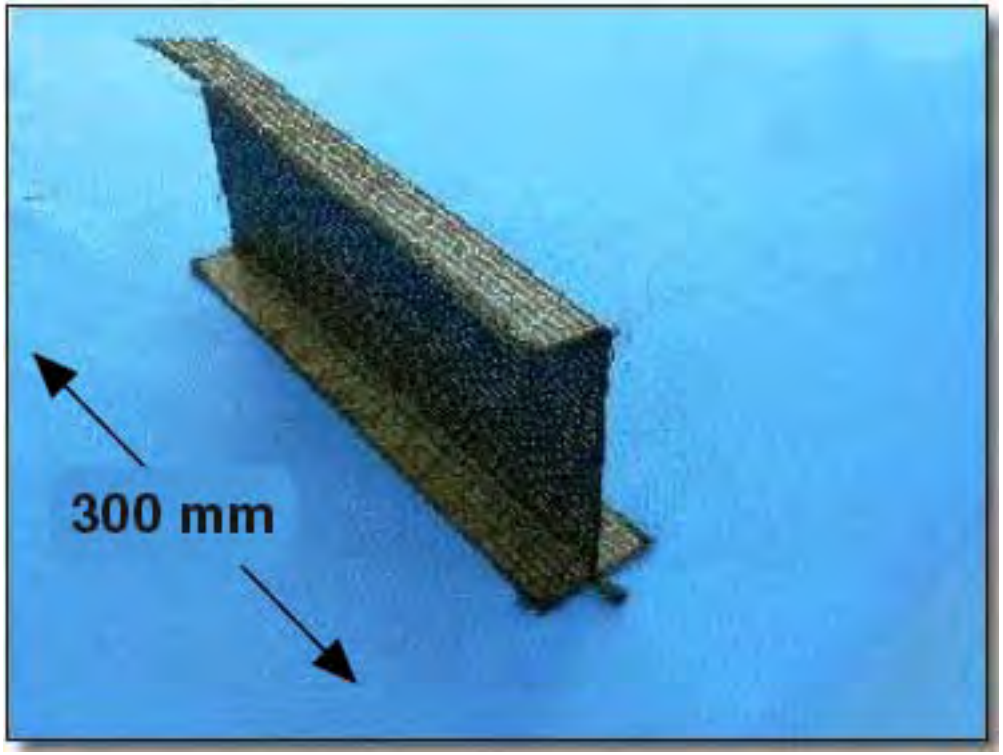
Organo-phosphorus Compounds

Flame Retardancy combined to Toughness Modifier





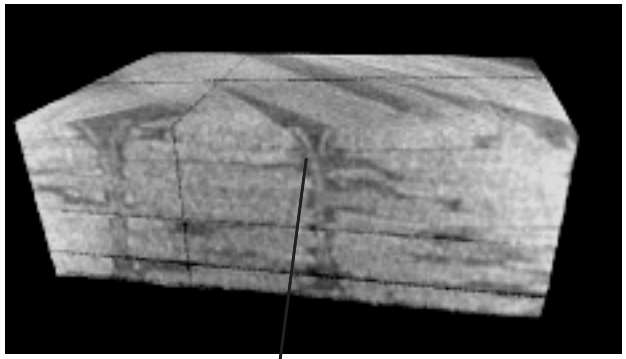
Stitched Preforms for CFRC



RESEARCH FIELD

Stitched Preforms for CFRC

Investigation of innovative preform stitching for RTM



Yarn for Preform Stitching

RTM Mould