

# Generation and Characterisation of Realistic Wrinkles in an AFP Representative Experiment Setup

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## Summary:

A novel experiment was developed to establish a relation between tension and wrinkling, where realistic wrinkles of varying fibre orientations, amplitudes and wavelengths were achieved. The wrinkled layers were combined to form a quasi-isotropic laminate containing multiple defects and the wrinkle's evolution to post-cure waviness was analysed.

## Experiment Setup

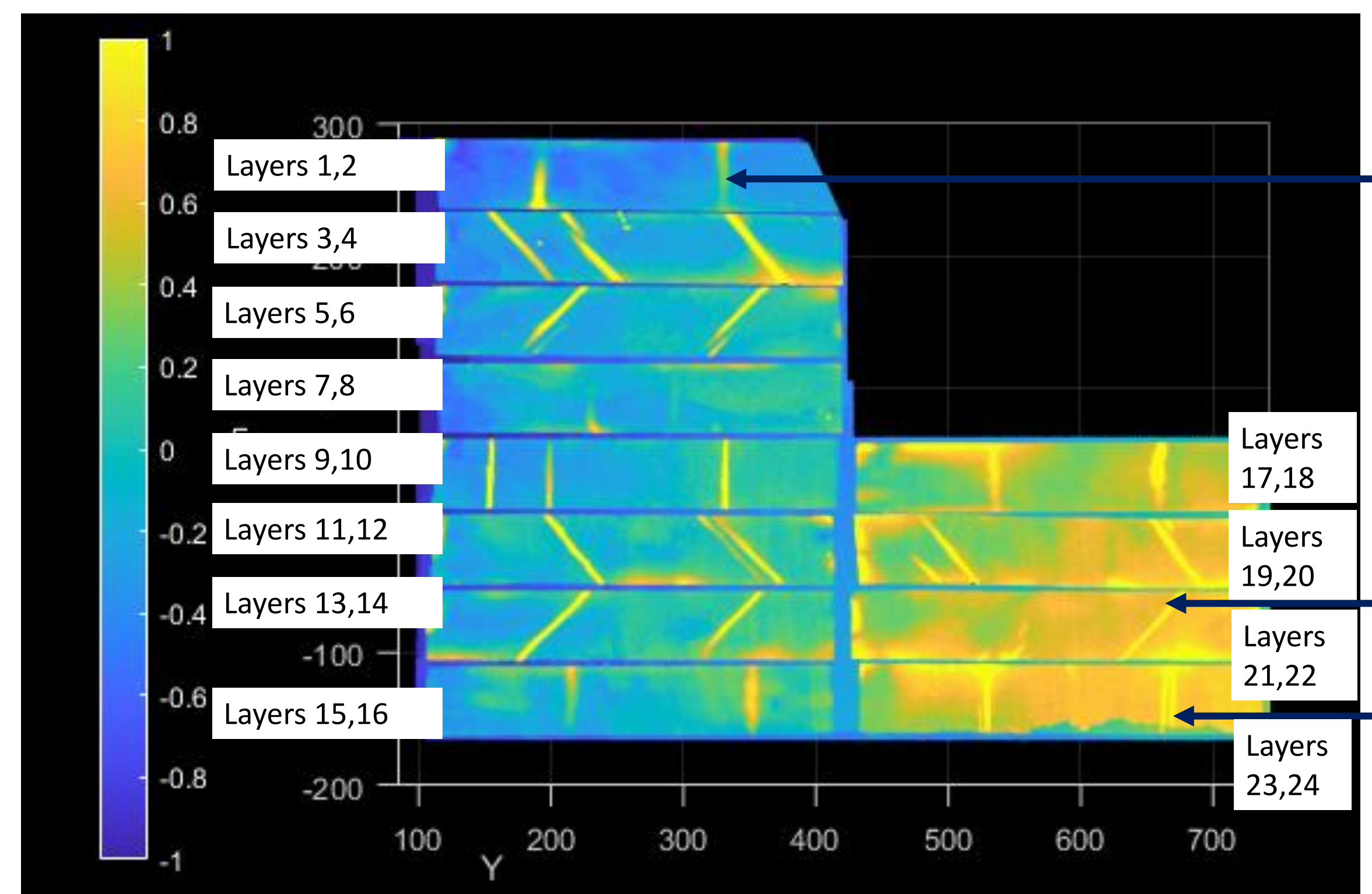
Longer, tensioned composite ply  
Shorter, applied composite ply



Tensile testing clamps

Backplate with tactile sensor

Experiment setup where tension is applied to the initial layer and released, causing wrinkling

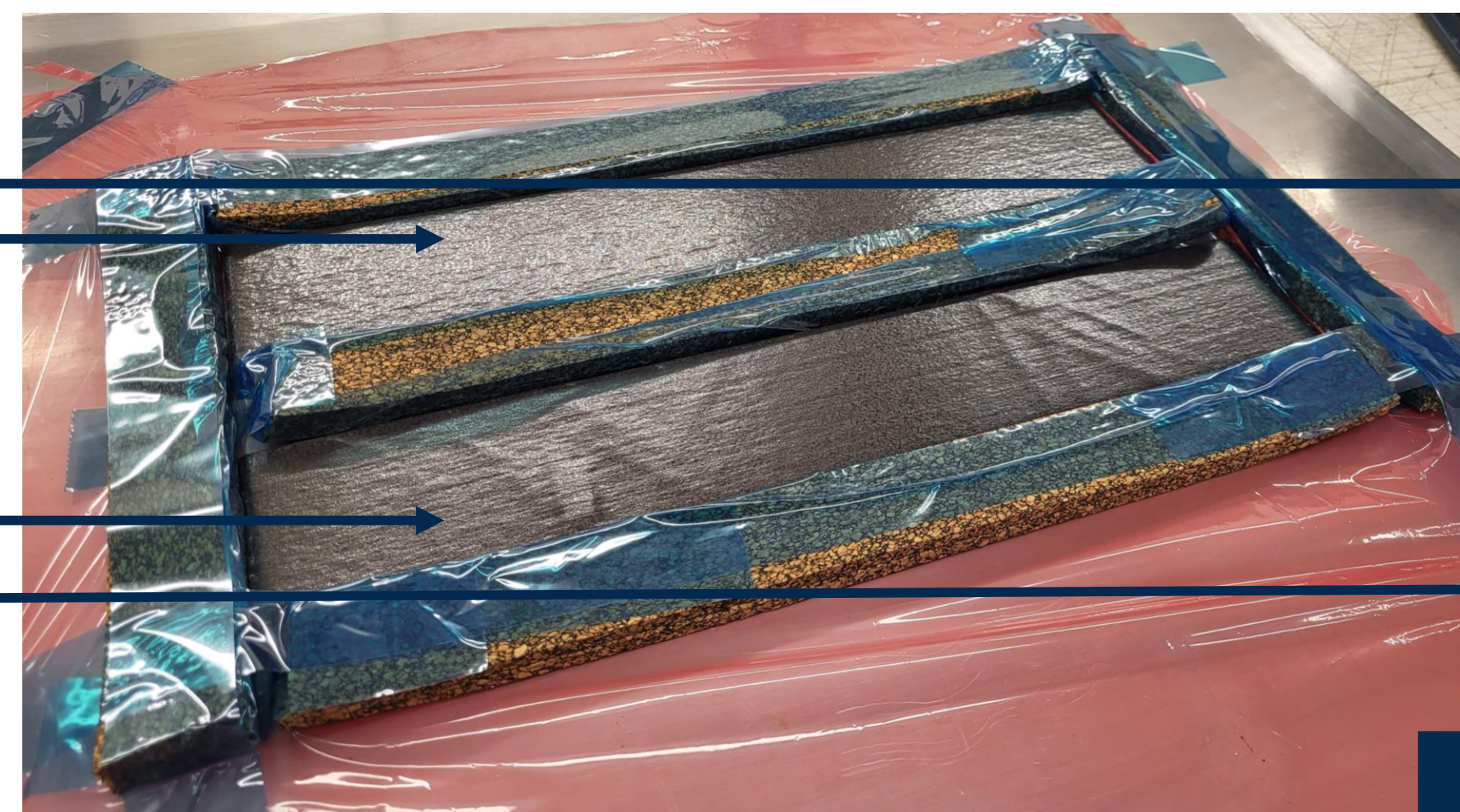


Laser scan of wrinkles before combining individual layers to form the quasi-isotropic laminate containing defects

## Generating the wrinkles:

- Apply tension to a ply of composite prepreg, representative of its state during AFP deposition.
- While under tension, apply a secondary ply to the initial layer using a backplate and roller.
- Release the tension, causing wrinkling within the scale of 0.1-0.5 mm.

Control Laminate (No defects)  
Sample containing multiple defects



Quasi-isotropic laminates after debulking, before autoclaving

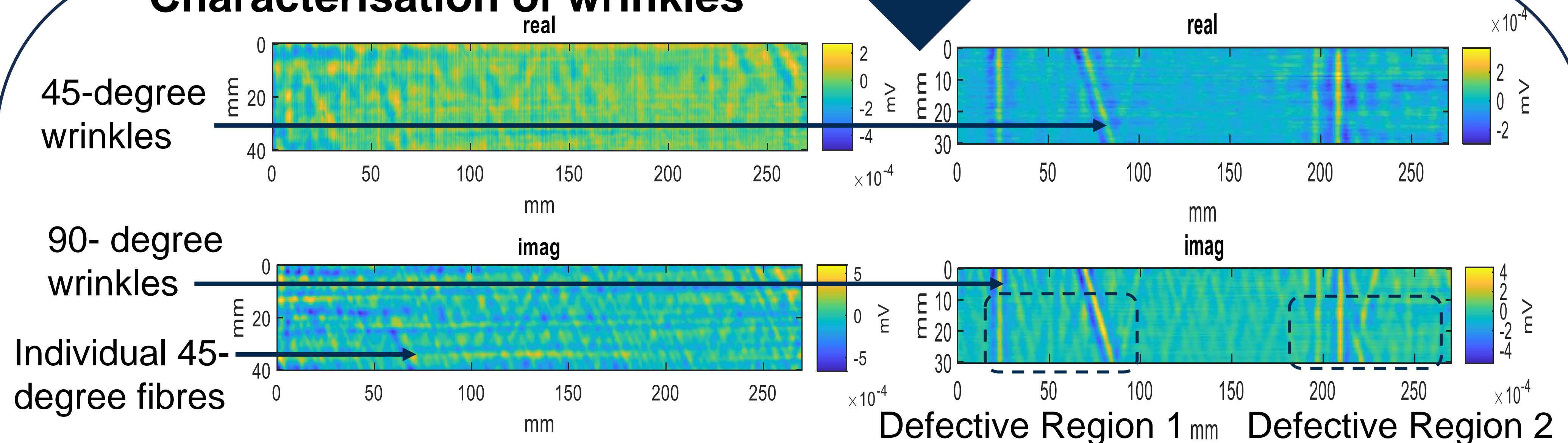


Composite laminates after autoclaving and trimming

## Characterising the Wrinkles:

- Combine wrinkled layers into a quasi-isotropic laminate and cure using an autoclave.
- Characterise post-cure waviness using eddy current sensors and section analysis.

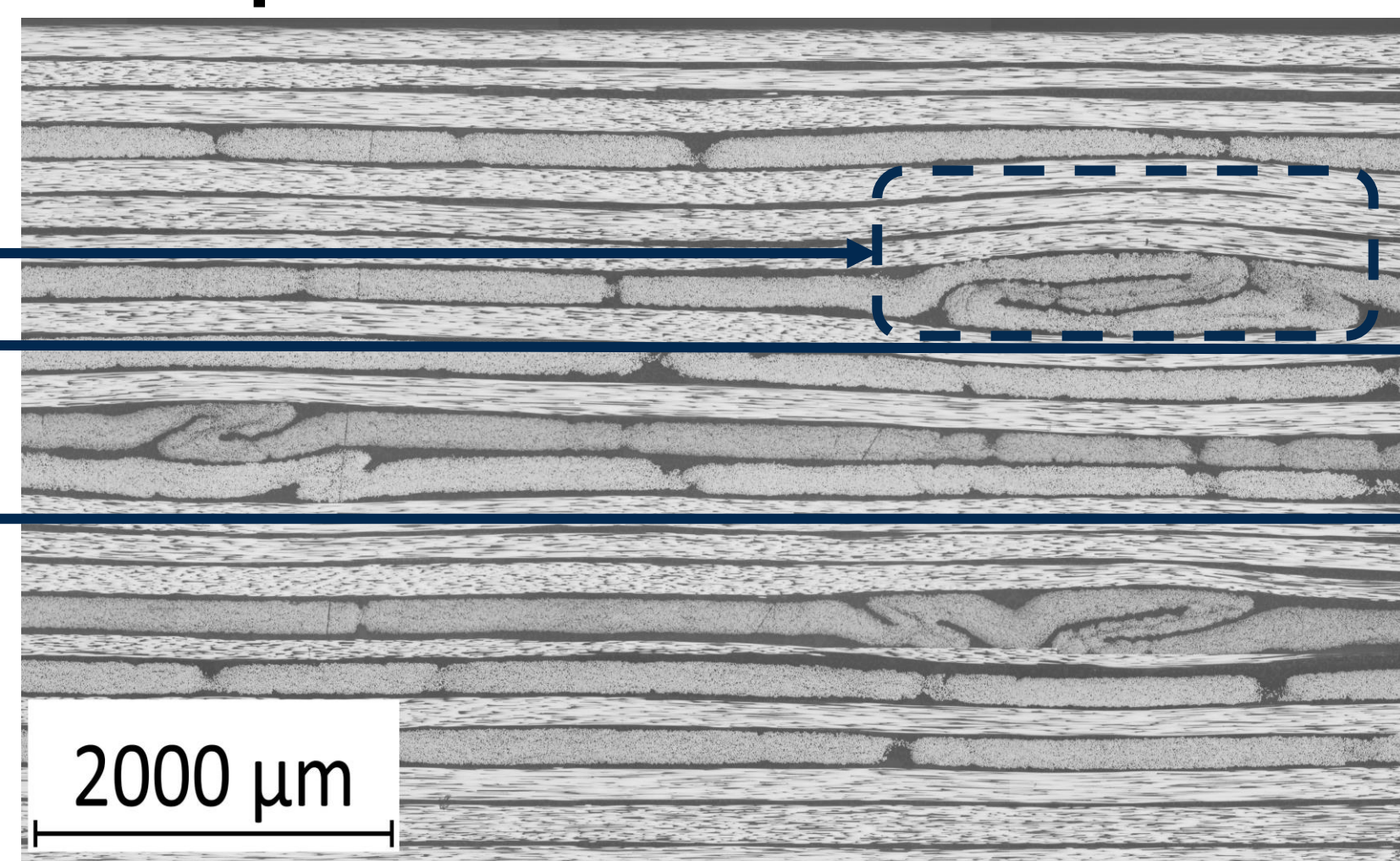
## Characterisation of wrinkles



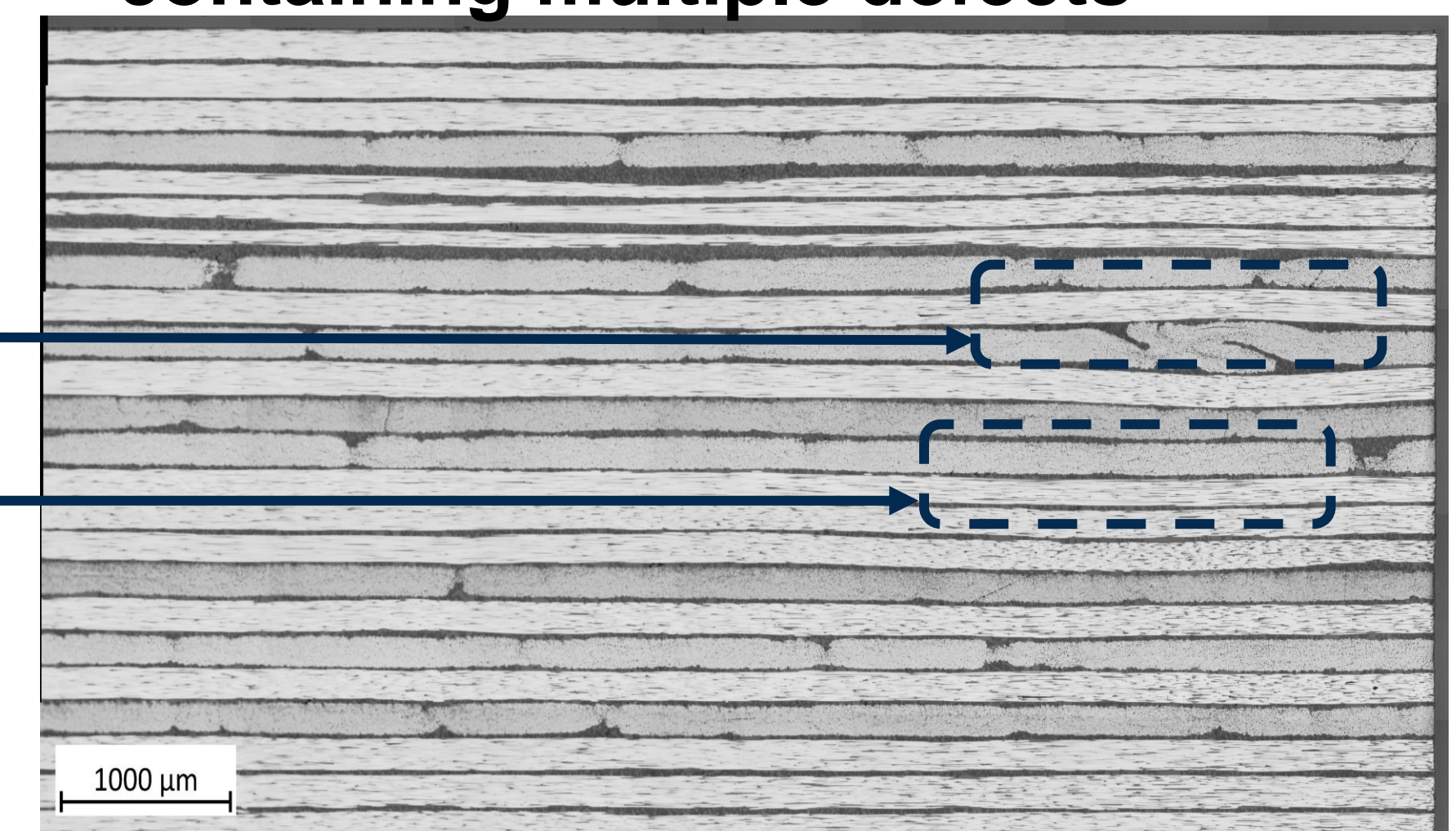
Eddy-current scan of the control sample

Eddy-current scan of the sample containing multiple defects

45-degree wrinkle  
90-degree wrinkle  
0-degree in-plane waviness



Side-profile micrograph of defective region 1



Side-profile micrograph of defective region 2

## Future Work:

- Varying the initial tension to correlate with the wrinkle parameters.
- Varying the applied pressure and heat to correlate wrinkle parameters to tack.