

# Mechanical characterization of a novel epoxy adhesive

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## ABSTRACT

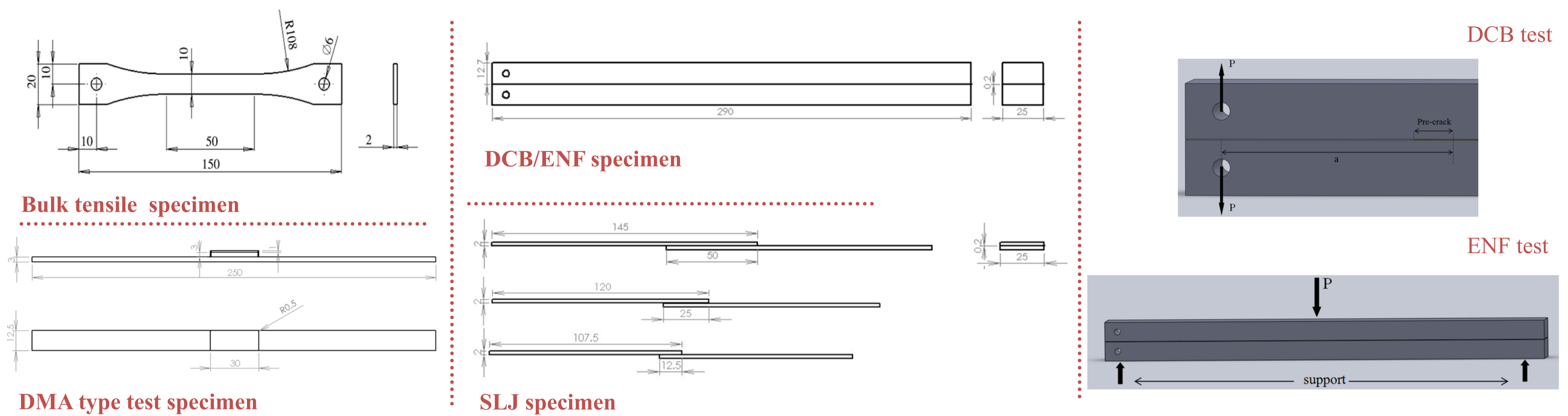
In this study, a new epoxy adhesive has been mechanically characterized. Epoxy adhesives are known for their high tensile strength, high shear strength, low elongation and low toughness. In this case, the adhesive presents an improvement of these properties. It combines the properties of an epoxy adhesive and a typical polyurethane (PU) adhesive, such as high elongation and high toughness. A new adhesive with these combined properties is an excellent solution to be used as a structural adhesive, especially when high toughness is required such as in the automotive industry. Experimental tests were performed to measure the tensile properties, shear properties, thermal properties and fracture properties. The tensile test shows a high tensile strength and a high elongation. The single lap joint (SLJ) test shows that the failure load is proportional to the overlap length which is typical of a highly ductile adhesive. The toughness in mode I of the adhesive was determined using the double cantilever beam (DCB) test and the toughness in mode II using the end notch flexure (ENF) test. The toughness is much higher than for conventional epoxy adhesives, and can be compared to that of a PU adhesive.

## EXPERIMENTAL PROCEDURE

### MATERIALS

- Epoxy adhesive XNR6852 (supplied by Nagase Chemtex, Japan). One-part system that cures at 150 °C for 3h.
- In the SLJ, DCB and ENF tests, heat treated steel was used to avoid plastic deformation of the substrates.

### SPECIMENS

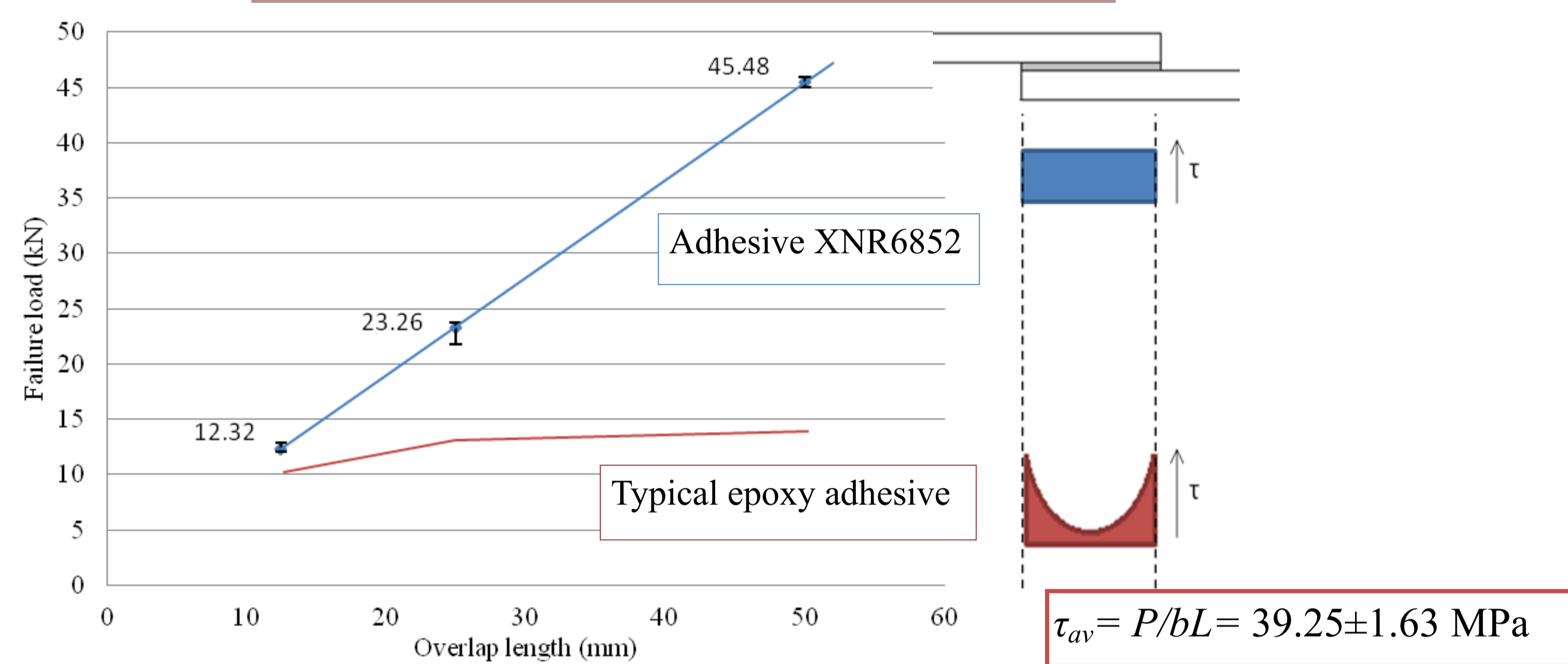


## RESULTS

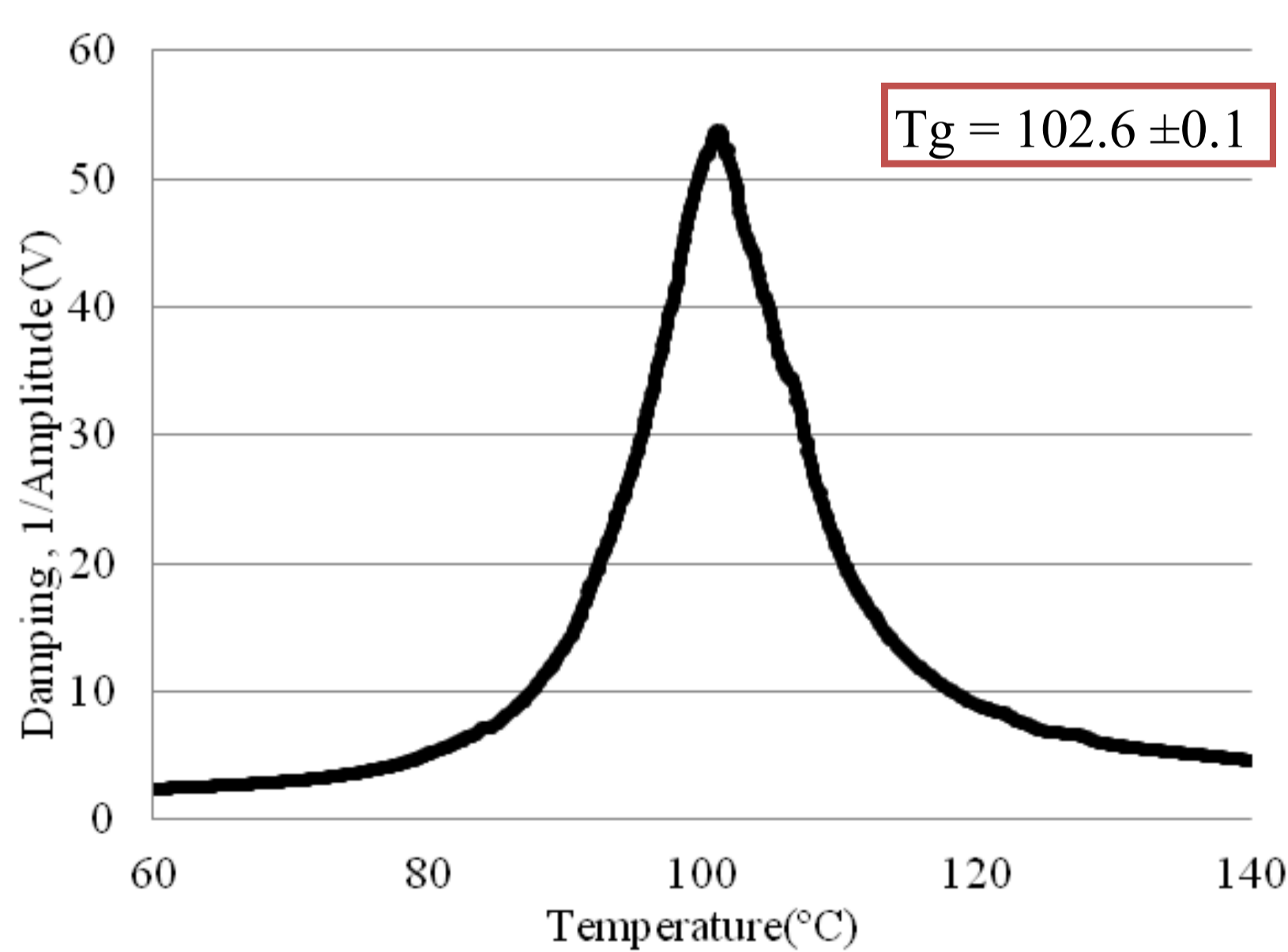
### Bulk tensile test

Properties	Average value XNR6852	Conventional toughened epoxy adhesive
Tensile strength (MPa)	59.88±0.84	60
Young's modulus (MPa)	1176.28±39.90	2400
Strain (%)	100.71±25.52	3

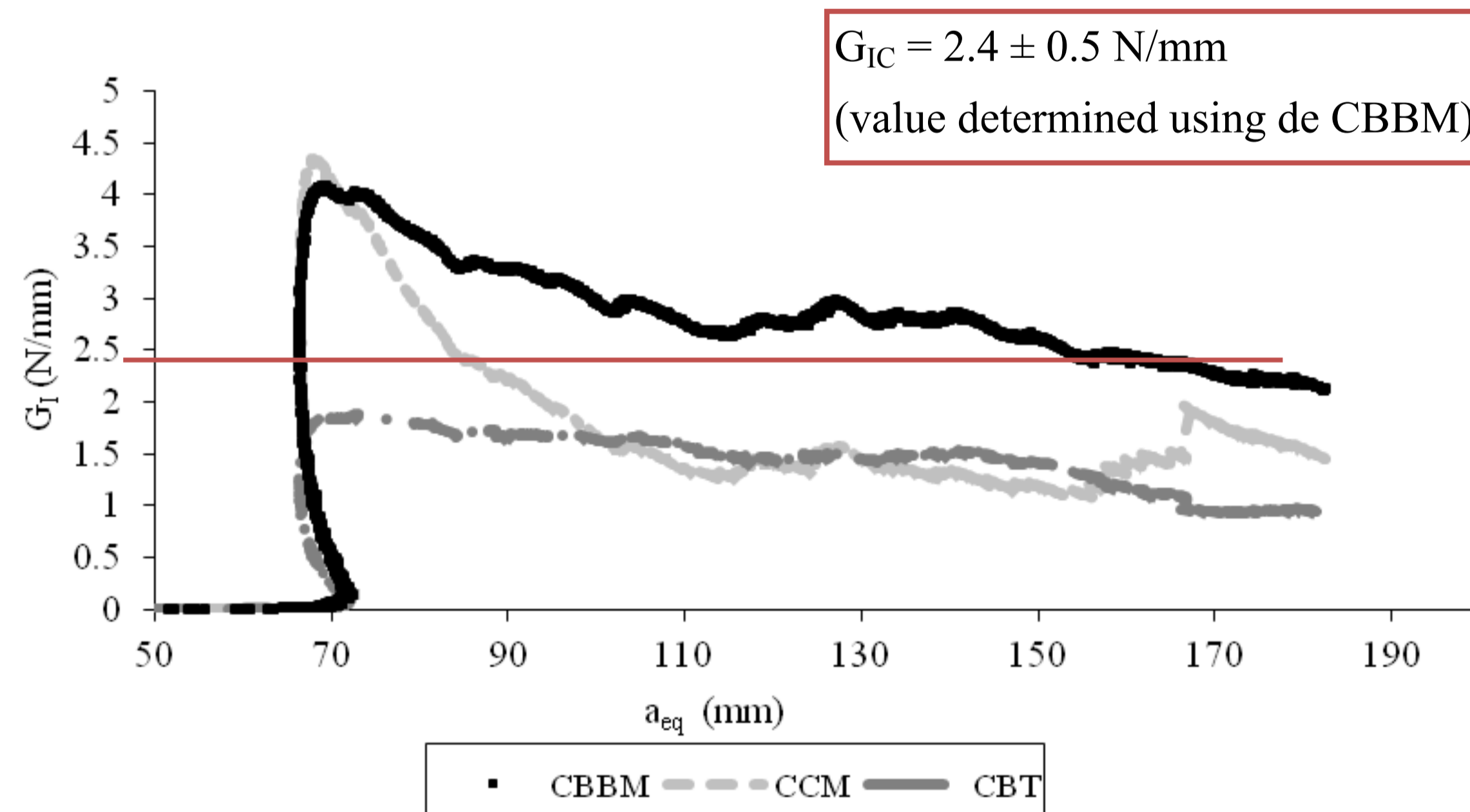
### Single Lap Joint (SLJ) test



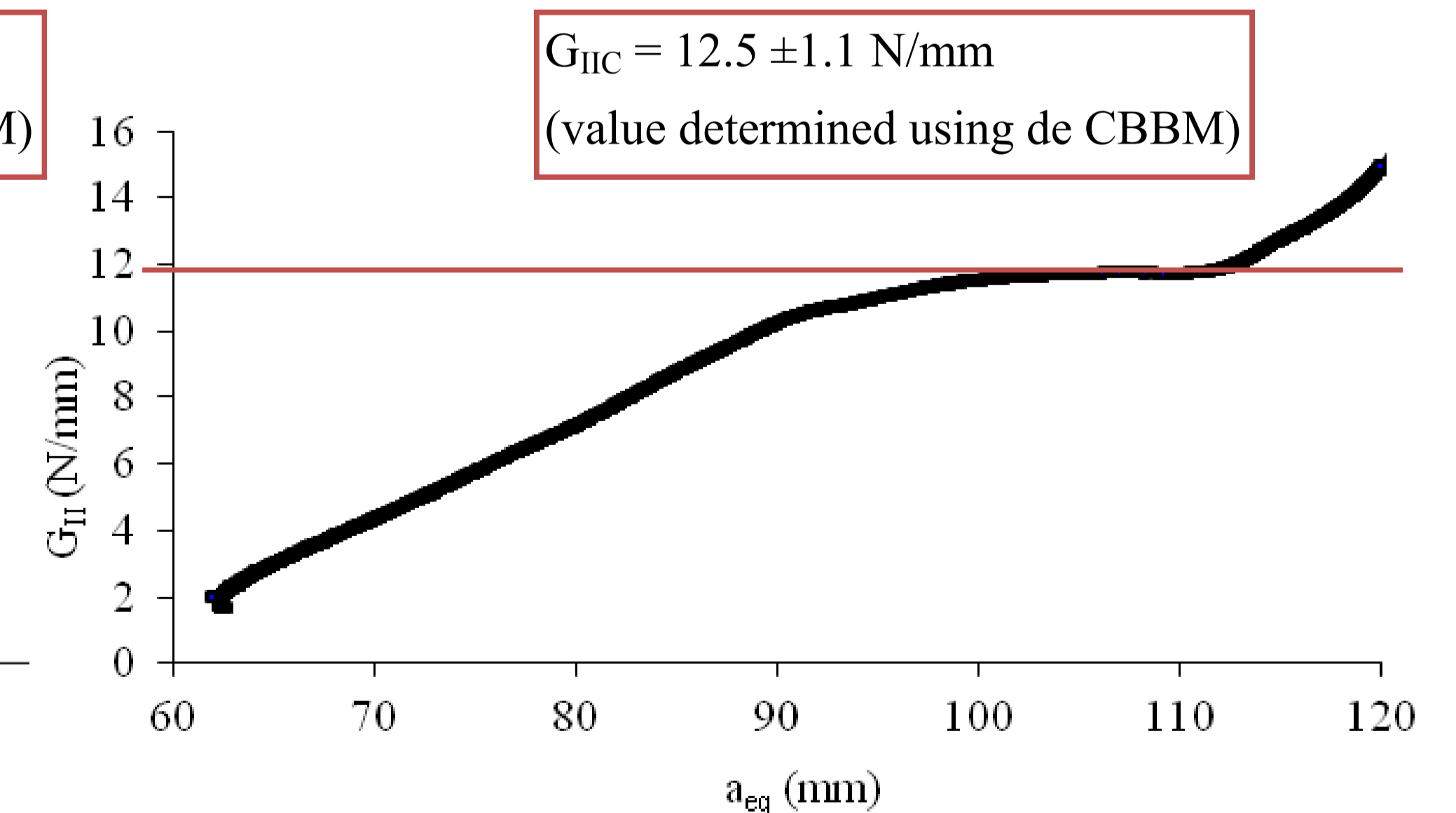
### DMA type test



### Double Cantilever Beam (DCB) test



### End Notched Flexure (ENF) test



## CONCLUSIONS

The novel epoxy adhesive, XNR 6852, has a good relation between strength and toughness:

- High tensile strength, typical of an epoxy adhesive.
- High elongation, typical of a polyurethane adhesive.
- High shear strength, typical of an epoxy adhesive.
- A linear relation between failure load and overlap length in SLJs showing a ductile behavior.
- High toughness, typical of a polyurethane adhesive.

In short, this novel adhesive combines the best properties of epoxy and polyurethane adhesives being a great solution for the automotive industry.

## ACKNOWLEDGMENTS

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