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Poster n°18

# Marine durability of a filled elastomer

How to predict mechanical properties during seawater ageing?

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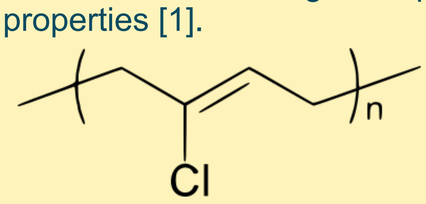
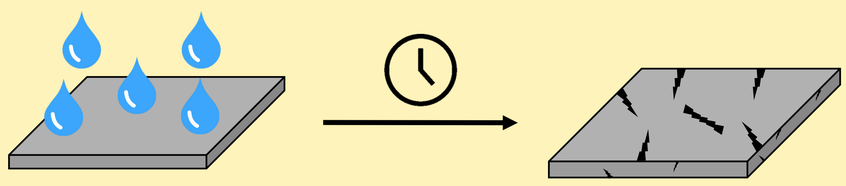
## 1 Context & objective

Polychloroprene (CR) is often used in marine renewables for its high damping and fatigue properties [1].




Exposition to seawater ageing → Changes in CR mechanical properties [2].

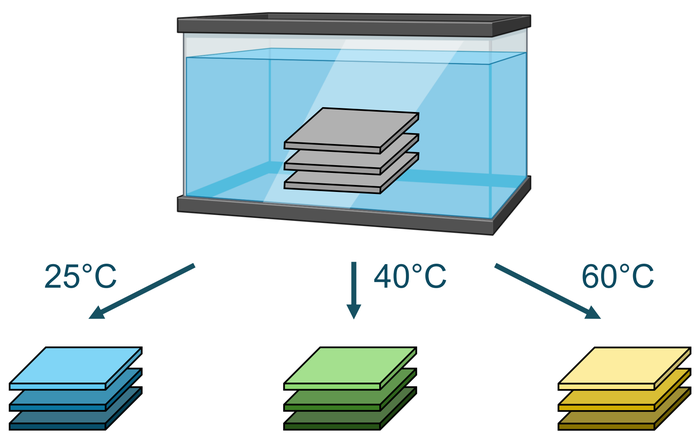


→ Material **long-term durability**?

→ Impact on **static & dynamic** properties?

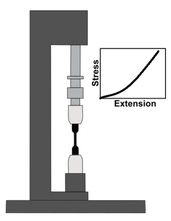
## 2 Ageing & Testing

Samples are immersed in heated natural seawater in our laboratory, at 3 different temperatures, for various ageing durations.



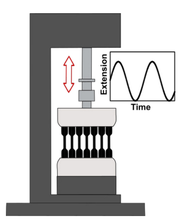

They are then tested to evaluate the change in mechanical properties induced by seawater ageing.

**Quasi-static tests**




→ Extension at break $\lambda_b$

**Dynamic tests**

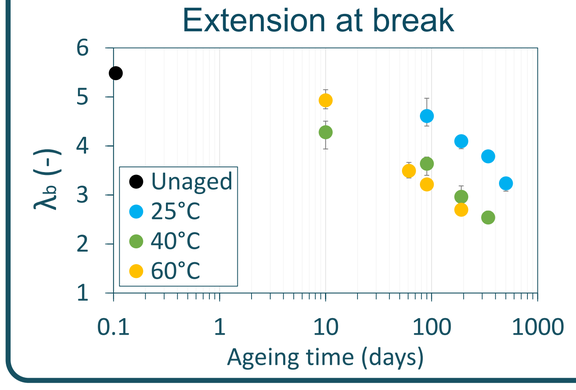



→ Fatigue lifetime N

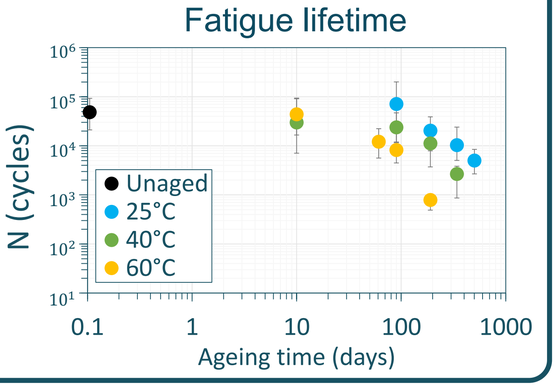
## 3 Results

Mechanical properties drop through ageing, regardless the temperature.

Extension at break



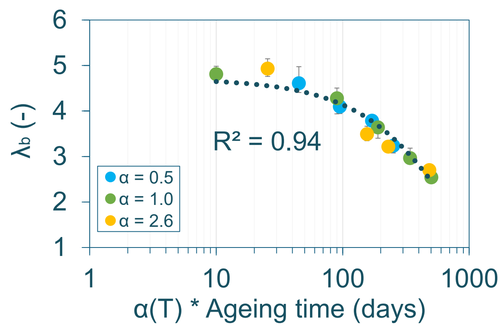

Fatigue lifetime




## 4 Modelling strategy

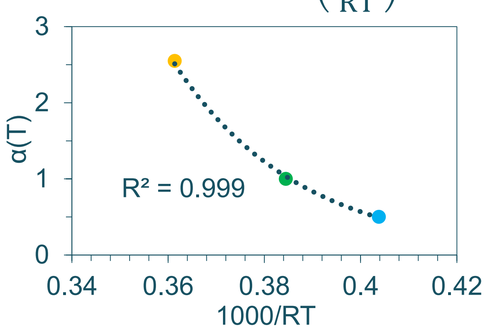
Exponential law master curves

$$\lambda_b = \lambda_b^0 \exp(-A * \alpha(T) * t)$$




Arrhenius law [3]: activation energy Ea

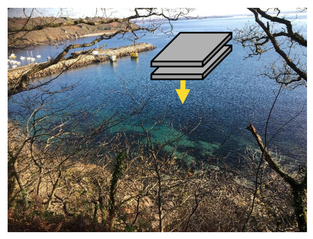
$$\alpha(T) = \alpha^0 * \exp\left(\frac{-E_a}{RT}\right)$$

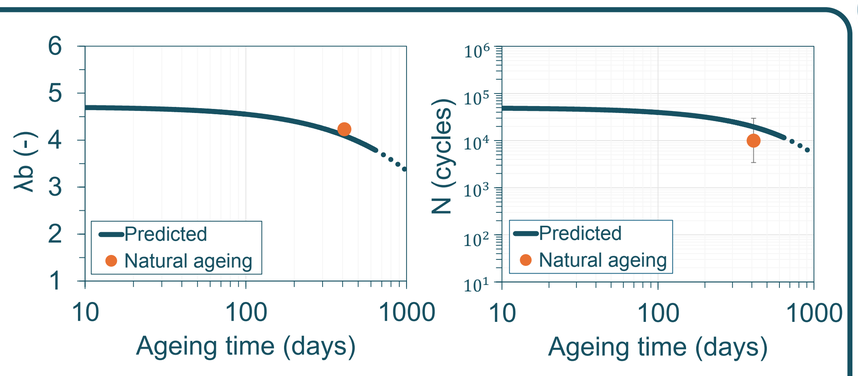



→ Model yields satisfactory **description of properties decline**, $\lambda_b$ and N.

## 5 Validation

To validate the model, samples have been immersed directly in the Brest bay (> 1 year), and tested.






→ Predictions **align** very closely **with on-site data.**

## 5 Conclusions

- ✓ Seawater durability predictions.
- ✓ Validation with on-site ageing.
- ☆ Holds promise for elastomer parts design & maintenance.

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[1] K. Lee et al., Ocean Eng. 72 (2013)
[2] P-Y. Le Gac et al., Polym. Degrad. Stab. 192 (2021)
[3] V. Le Saux et al. Polym. Degrad. Stab. 99 (2014)