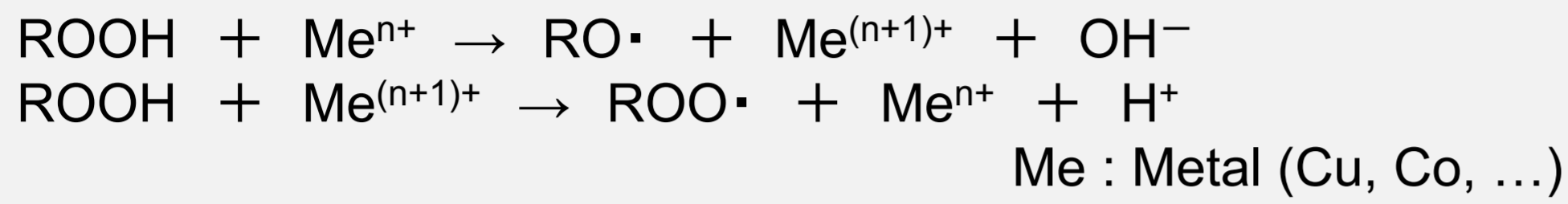


Stability of encapsulants using various string-ribbons

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Motivation

Replacing a Cu string-ribbon with Al can effectively cut the cost of a photovoltaic module.
Furthermore reducing the usage of Cu is expected to realize long-life encapsulants because Cu acts as a catalyst of thermal-oxidative degradation of polymer.



Therefore, we have compared the degradation of encapsulants using various string-ribbons by discoloration and mechanical strength.

Conclusions

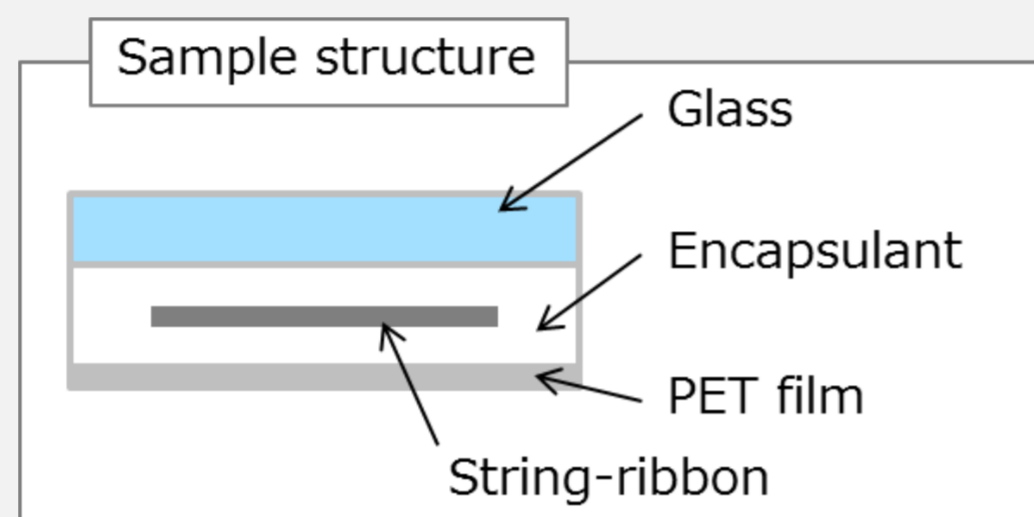
- Cu acts as a catalyst for the thermal-oxidative degradation of encapsulants.
- The degradation rate differs among encapsulants.
- Encapsulants which show large degradation with Cu-ribbon show no degradation with Al-ribbon.

Discoloration

(1) High temperature storage test

Condition

- 130 °C
- 1000 hours
- Ambient air

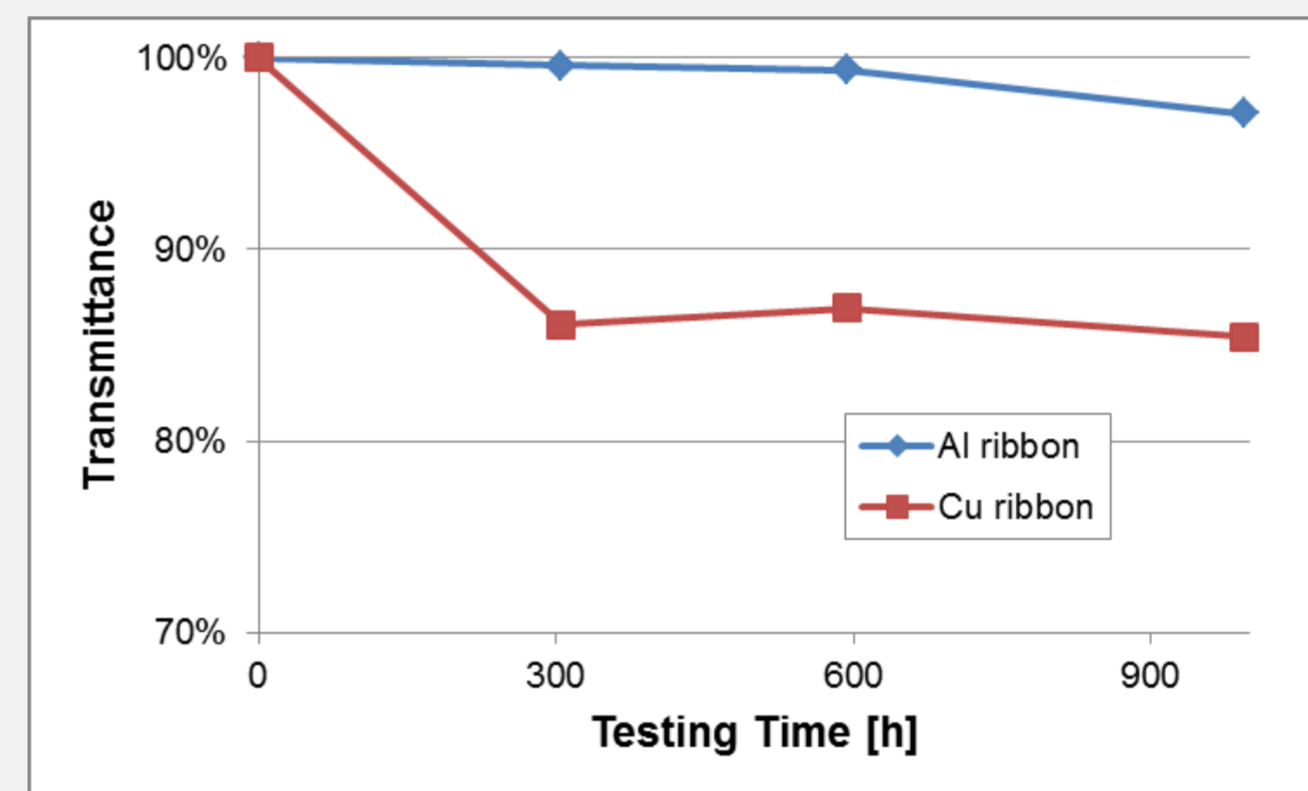


(2) Evaluation method

- Reflectivity measurement
- Appearance inspection

(3) Results

The encapsulant in contact with Cu-ribbon is discolored, whereas no discoloration is observed with the Al-ribbon.



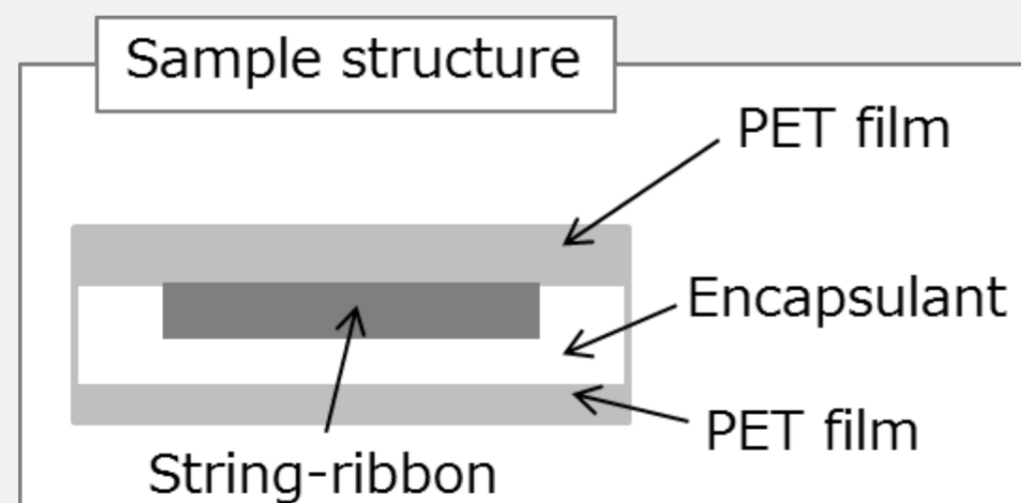
Cu acts as a catalyst for the thermal-oxidative degradation of encapsulants.

Tensile strength

(1) High temperature storage test

Condition

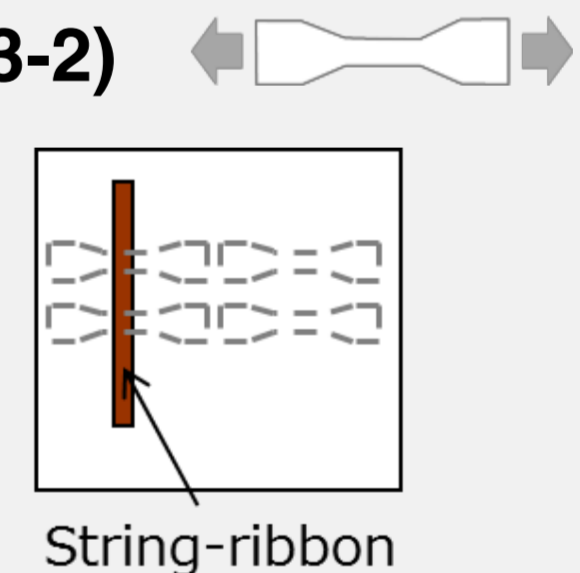
- 130 °C
- 600 hours
- Ambient air



(2) Evaluation method

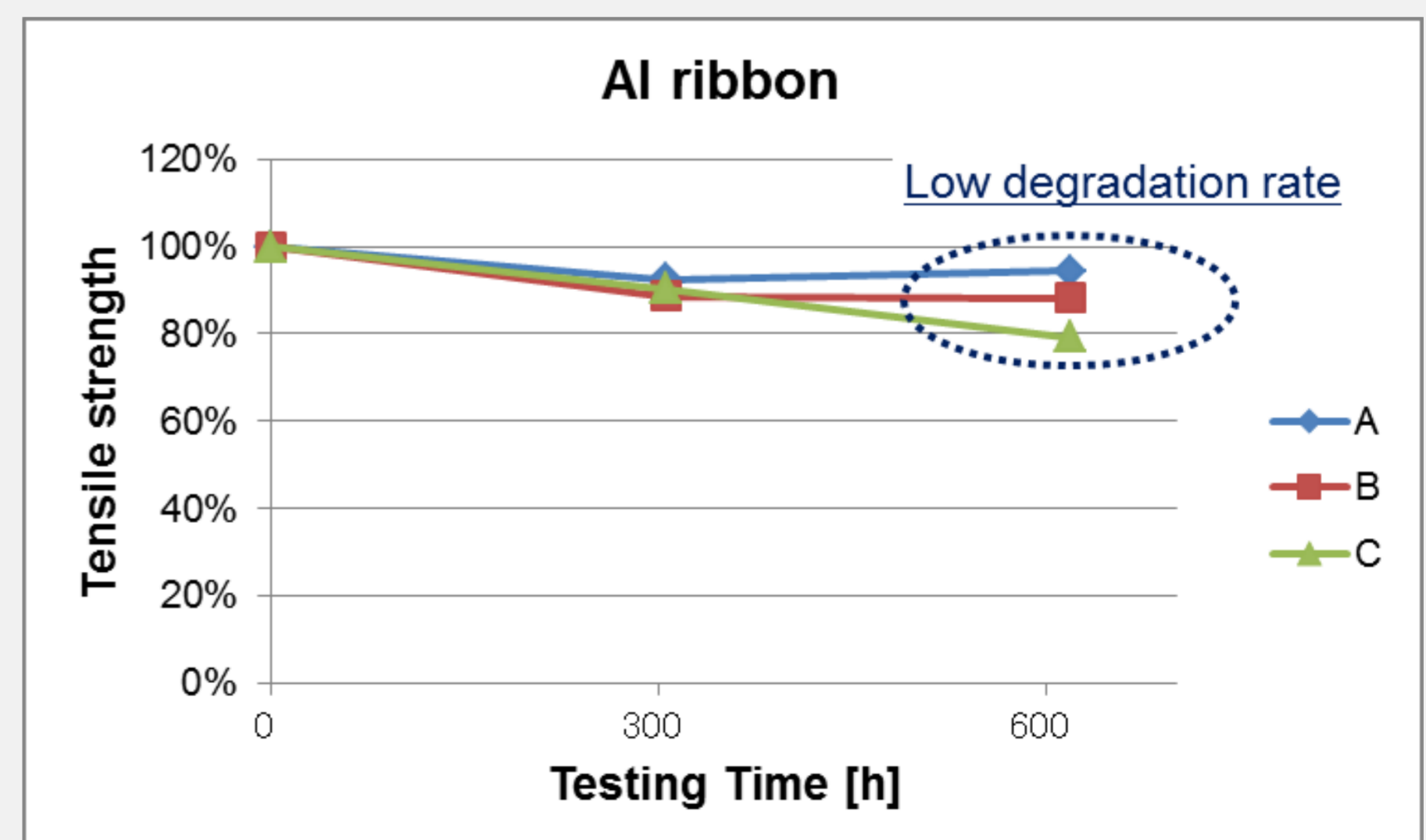
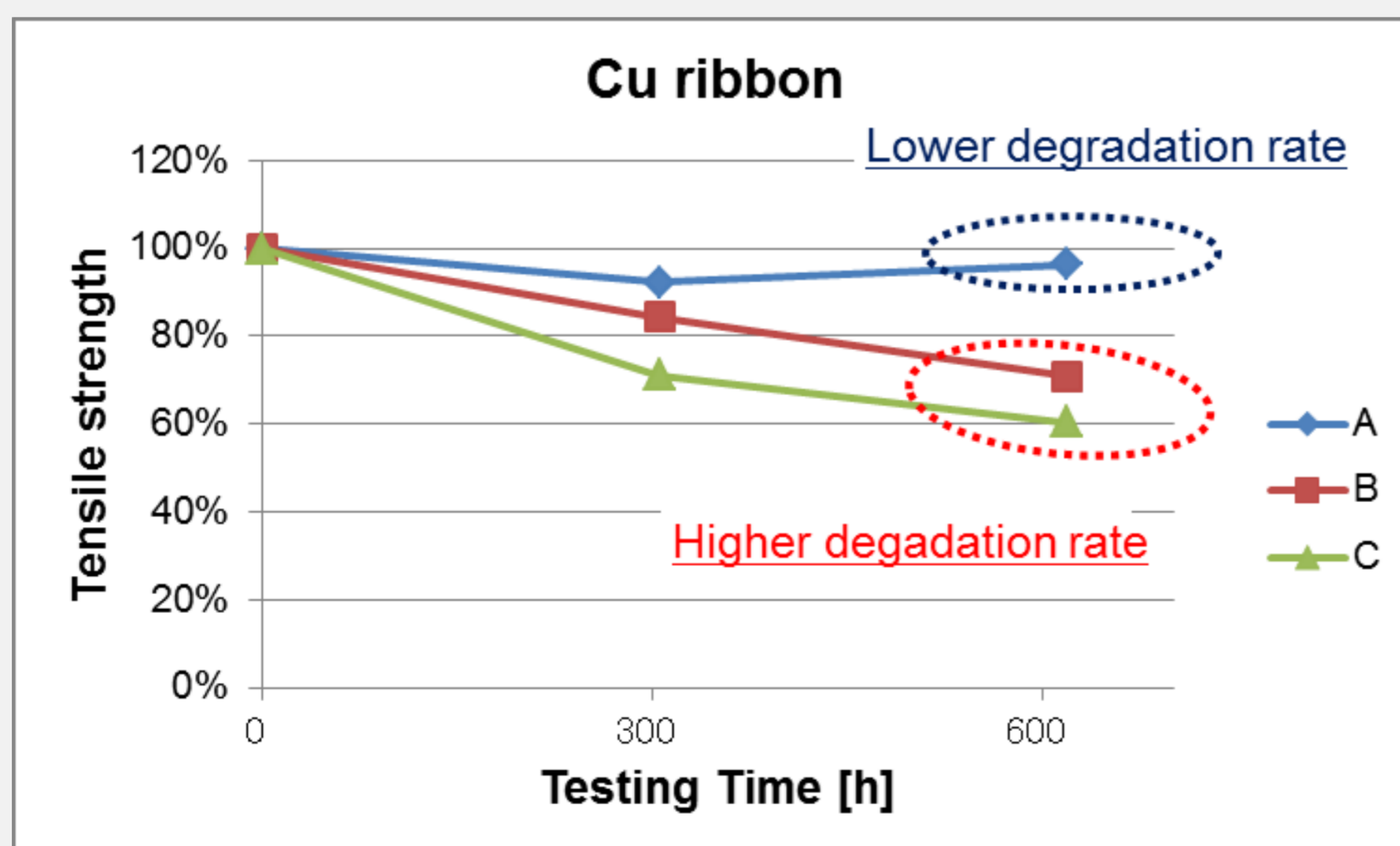
Condition

- Dumbbell shape (JIS K7113-2)
- Room temperature (25 °C)
- 4.0 mm/sec



(3) Results

- The tensile strength of encapsulants using the Cu-ribbon decreases over testing time, and the degradation rate differs among encapsulants.
- Encapsulants that show large degradation with the Cu-ribbon show no degradation with the Al-ribbon.



Sample	A (PO)	B(EVA)	C (PO)
Cu ribbon	○	△	△
Al ribbon	○	○	○

Replacing the Cu-ribbon with the Al-ribbon increases options of the encapsulants; in other words, it has the potential to reduce cost of the encapsulants.