

To quickly estimate the durability of coatings, a rapid weatherability test method with excellent outdoor-reproducibility has been developed.

The test method consists of alternately repeating treatments A and B. Treatment A is UV irradiation in 3wt% aqueous hydrogen peroxide solution at 40°C. The UV irradiance (wavelength: 300 - 400 nm) at the coating surface was 50W/m². When treatment A was applied to a white coatings film with a smooth surface (**Fig.** 1(a)) containing TiO₂ pigment for 30h, a number of small pits were formed on the surface due to vehicle loss around the TiO₂ pigment caused by photocatalytic oxidation (Fig. 1(b)). The small pits are one of characteristic morphologies observed in outdoor-exposed coatings films containing TiO₂ pigment.



Fig. 1 SEM images (60° tilted view) of coatings surface. (a) No treatment

- (b) After 30h of treatment A
- (c) After 100h of treatment B
- (d) After 132h of cyclic treatment
- (e) After 2-year outdoor exposure

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Treatment B is UV irradiation in 80kPa oxygen and 20kPa water vapor (relative humidity of 40% RH) at 80°C. The UV irradiance was 75W/m². When treatment B was applied to the same white coating film for 100h, a small waviness appeared on the surface due to vehicle shrinkage caused by hydrolysis and oxidation (Fig. 1(c)). This is also one of characteristic morphology of outdoor-exposed coating films.

Treatments A for 2h and B for 20h as one cycle (22h) were applied to the above-mentioned coating film. After 6 cycles (test time: 132h), the pits and waviness were formed on the surface and part of the TiO₂ pigment was exposed due to the entire loss of resin around TiO₂ pigment (Fig. 1(d)). These characteristics of the surface morphology coincided with those of the coating film outdoor-exposed for two years (Fig. 1(e)). Gloss changes in the three white and one purple coating films during these tests were almost identical to those of the outdoor-exposed coating films when the test time is multiplied by 100 as shown in Fig. 2. It is clear that the developed test method reproduces the gloss and surface morphology of outdoor-exposed coatings with an acceleration factor of 100.

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Fig. 2 Gloss change by cyclic treatment and outdoor exposure.