Evaluation of Wood Plastic Composites (WPC) overaly bonding quality to the birch plywood

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MOTIVATION

Numerous scientists are closely related with studies of green composite materials properties. Wood plastic composites (WPC) are ones of them because WPC are perspective and widely used materials in different branches of industry [1-2]. In researches [3-6] are shown that plywood production by-products as reinforcement of polypropylene (PP), are able successfully combine. Plywood are being used a lot in construction industry with heavy loads and it's needing to be protected. Traditional paper-resin laminates are thin and easy damageable while thick plastic laminates are expensive. Our investigation focusses on WPC composite usage as overlay and adhesive activity between the birch plywood. Results show adhesion strength differences between damaged and non-damaged overlay

EXPERIMENTAL

As an overlay where used PP+45 wt.% plywood sanding dust (PSD) WPC material extruded sheets made by twin screw extruder (thickness 2 mm). As an adhesive, industry used melamine -urea-formaldehyde (MUF) glue (100g/m^2). Plywood "Riga Ply" was WGE class, thickness 12mm. Samples for investigations were prepared like described in [3, 4]. Evaluation of bonding quality experiments were done according to the European Standard EN 311:1992. In all tests 15-20 parallel samples were used. The adhesion fracture mechanisms of the samples were evaluated visually. Samples were used as shuttering system panels – each time was 72h long (concrete "SAKRET BH" hardening time).

RESULTS & DISCUSSION

Samples were prepared with different deep scratches on protective WPC (PP+45 wt.% PSD) overlay. 50-100 mikron deep damages are usually made transporting or machining plywood. It's visible but it's hard to feel it by hand. 100 – 250 mikron deep scratches are usually made during the usage process – shuttering systems for construction industry. Average resin-paper laminated plywood panel usage for shuttering systems is 7-15 times. Adhesive strength experimental results are presented in the Table 1. All these measurements show that average bonding strength between WPC (PP+45 wt.% PSD) overlay and plywood was higher than between plywood layers.

Table 1. Sample boning strength after usage.

Damage deep	Non-used N/mm^2	1 time N/mm^2	3 times N/mm^2	5 times N/mm^2	10 times N/mm^2
0 mikrons	2,79	2,70	2,77	2,72	2,66
50 mikrons	2,81	2,66	2,72	2,74	2,80
100 mikrons	2,68	2,79	2,69	2,67	2,76
150 mikrons	2,73	2,75	2,68	2,78	2,79
250 mikrons	2,67	2,80	2,74	2,69	2,71
500 mikrons	2,72	2,69	2,78	2,66	2,29

Non-used test samples showed similar bonding strength values as 1, 3, 5, and 10 times used as shuttering system samples. Only exception was 500 mikron deep damaged samples. Bonding strength is ~15-16% less compared to the other samples. These samples also were broken between WPC overlay/plywood surface. Since WPC absorb water, which may affect bonding quality, these kinds of damages are weak points but not critical, because bonding strength is more than minimum (1 N/mm^2) according to the EN 314 Plywood standard.

CONCLUSIONS

Tests showed that WPC overlay excellent possibilities of the usage as protective layer of the birch plywood. Only more than 250 mikrons deepe damages may affect adhesive bonding between WPC layer and plywood. Even if the damage is 500 mikrons deep, adhesion strength after 10 time using is only 16% less.

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