FinishLine

Forest Products Laboratory

Mill Glaze: Myth or Reality?

Since the mid-1980s, a condition called "mill glaze" (also called planer's glaze) has sometimes been blamed for the failure of a coating on smooth flat-grained siding and some other wood products. The exact cause of this problem has been a subject of controversy. Many people believe that the coating fails as a result of the planing and/or drying processes. They speculate that the milling or planing process overheats the wood and brings more water-soluble extractives to the surface, creating a hard varnish-like glaze. They attribute overheating to dull planer blades.

An earlier FinishLine ("Why House Paint Fails") described the problem of mill glaze according to reports we had received. We have tried to duplicate mill glaze failure in the laboratory. The tests have included planing lumber with dull blades at high feed pressures. We have been unable to obtain a "glazed" surface. This does not necessarily mean that mill glaze cannot happen; it means that we have not been able to duplicate it in the laboratory. Although research on "mill glaze" effect has not continued at FPL, we did investigate a number of reported mill glaze failures. In all cases, the failures were readily explained by other failure mechanisms, including raised grain, degradation of the wood surface by ultraviolet (UV) radiation prior to painting, insufficient thickness of the coating system, improper surface preparation, and moisture problems.

Raised Grain

The problem of raised grain (Fig. 1) is most severe on the pith side of flat-grained boards because of the orientation of latewood and earlywood. During planing, the bands are pressed into the surface and crush the earlywood bands beneath them. When the boards are exposed to weather, particularly cyclic moisture conditions, the crushed earlywood absorbs moisture and rebounds, pushing the latewood bands upward and resulting in raised grain. If the paint film is brittle or too thin, the film cracks. Single coats of oil-based finishes on flat-grained siding are particularly vulnerable to this type of failure. In vertical-grained wood, the earlywood/latewood bands are perpendicular to the surface. Because of this orientation, vertical-grained lumber is easier to plane and much less prone to raised grain than is flat-grained lumber.

UV Degradation

The UV radiation in sunlight degrades the wood surface. Exposure to UV radiation for as little as 1 week can decrease adhesion of paint to a smooth-planed surface, even though the degradation is not visible. Of course, longer exposure increases degradation.

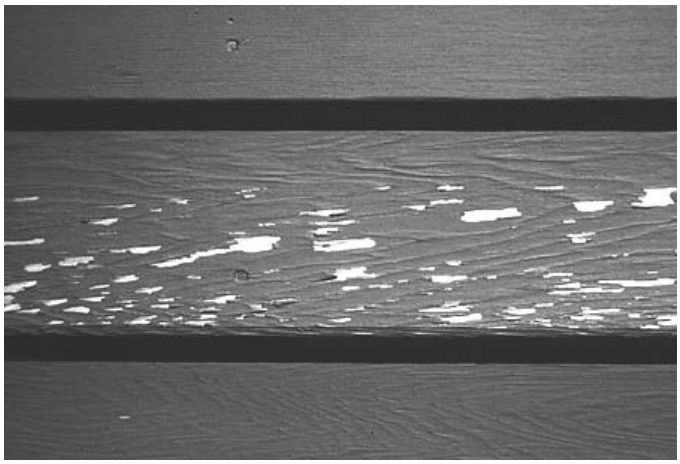

Figure 1—Solid-color oil stain failure caused by raised grain.

Wood surfaces that have been exposed to UV radiation for 3 to 4 months will be severely degraded. Paint on these surfaces will flake and peel much sooner than the same finish on undegraded wood surfaces.

Insufficient Film Thickness

Poor performance of the finish can be expected if the film thickness is inadequate, particularly for finish on flat-grained lumber or siding. One or two thin coats of oil-based solid-color stain (also called opaque or full-bodied stain) do not give adequate film thickness. Such low-solids coatings provide only 1 to 2 mils (one coat) or 2 to 3 mils (two coats) of film thickness, whereas a brush-applied three-coat paint system (primer and two top coats) provides 4 to 5 mils of film thickness (1 mil = 1/1,000 inch). Thin coatings of solid-color stain do not have enough film integrity to withstand the stresses caused by dimensional changes in the wood, particularly if the surface develops raised grain after the finish has been applied.

Improper Surface Preparation

Improper surface preparation can cause finish failure. If smooth-planed wood has been exposed to sunlight for more than a few days, the surface must be lightly sanded to remove damaged wood (weathered surface) before the finish is applied. Wood should also be lightly sanded before finishing if it has been stored for several months. Sanding reactivates the surface and allows better paint adhesion. The best sandpaper for sanding is around 80 grit. Do not use a wire brush or steel wool because iron contamination will later stain the wood. If the wood is dirty or has

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mildew, wash the surface before sanding and painting. A sheetrock sander works quite well for sanding the weathered surface or raised grain.

Effect of Moisture Content

The moisture content of finished wood should be the same as the typical in-service moisture content. Changes in moisture content cause dimensional changes that put stress on the finish. Application of the finish to wood with high moisture content can result in peeling.

Prevention of Finish Failure

The simplest and best solution for preventing failure of the finish on flat-grained siding is to install the siding with the saw-textured (rough) side out. The saw-textured side is the side of choice for improving the service life of penetrating semitransparent stains. The saw-textured side is also preferable for solid-color stains. Applying the finish to the saw-textured side increases film thickness and mechanical adhesion or "bite." The best film thickness is obtained by brush application. If the finish is applied by roller or spray, back-brush the finish immediately after application to even it out and work it into the wood surface. This will prevent bridging and gaps in the finish.

If flat-grained siding "must" be installed smooth side out, use a top quality three-coat paint system that includes a stain-blocking primer. In selecting a finish for highly colored wood such as western redcedar or redwood, be sure that the primer is impervious to bleeding of water-soluble extractives. Oil-based primers block better than latex-based stain-blocking primers; however, they are more brittle, which is problematic for woods that move a lot. Cedar does not move a lot and has been traditionally primed with oil primers. Extractives might bleed into latex stain-blocking primers but rarely continue into the topcoat if fully cured. A second coat of primer might be needed in a few spots. Solid-color stains, particularly latex formulations, do not block bleeding of extractives, especially if only one coat is applied.

Raised grain can be prevented by wetting the wood, which relieves surface stresses, but it's not really necessary if the primer is water based. For smooth siding, new or weathered, sanding can enhance the performance of a film-forming finish. Sanding makes no sense for saw-textured siding. The performance of the finish can also be improved by cleaning the wood with detergent and water or a commercial cleanser. However, use care in selecting a cleaning agent because strong detergents and commercial cleansers that contain strong alkali can leave residues in the wood. These residues may cause early finish failure.

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