

Introduction

High hardness yet not rigid and still recoatable coating is highly desired by all paint formulators, especially for those paints that need high abrasion resistance and mar resistance. Glass powder is a very hard material with Mohs Hardness Scale between 7-8, and they are even harder than normal stainless steel. Below are the explanations on hardness categorization of mineral.

Hardness

A good property in mineral identification is one that does not vary from specimen to specimen. In terms of reliability, hardness is one of the better physical properties for minerals. Specimens of the same mineral may vary slightly from one to another, but generally they are quite consistent. Inconsistencies occur when the specimen is impure, poorly crystallized, or actually an aggregate and not an individual crystal.

Hardness is one measure of the strength of the structure of the mineral relative to the strength of its chemical bonds. It is not the same as brittleness, which is another measure of strength, that is purely related to the structure of the mineral. Minerals with small atoms, packed tightly together with strong ionic bonds throughout tend to be the hardest minerals. The softest minerals have metallic bonds or even weaker van der Waals bonds as important components of their structure. Hardness is generally consistent because the chemistry of minerals is generally consistent.

Hardness can be tested through scratching. A scratch on a mineral is actually a groove produced by microfractures on the surface of the mineral. It requires either the breaking of bonds or the displacement of atoms (as in the metallic bonded minerals). A mineral can only be scratched by a harder substance. A hard mineral can scratch a softer mineral, but a soft mineral can not scratch a harder mineral (no matter how hard you try). Therefore, a relative scale can be established to account for the differences in hardness simply by seeing which mineral scratches another. That is exactly what French mineralogist Friedrich Mohs proposed almost one hundred and seventy years ago. The **Mohs Hardness Scale** starting with **talca** at 1 and ending with **diamond** at 10, is universally used around the world as a way of distinguishing minerals. Simply put; the higher the number, the harder the mineral.

Below is the Mohs Hardness Scale:

Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Orthoclase	6
Quartz	7
Topaz	8
Corundum (ruby and sapphire)	9
Diamond	10

In order to use this scale, it is necessary to have on hand some of the minerals in the scale. If you wish to test an unknown mineral for hardness you might want to start with an ordinary specimen of apatite to see if the unknown mineral can scratch it. If the unknown mineral scratches the apatite, then you can conclude that it has a hardness of 5 or more. If the apatite can scratch the unknown mineral, then the unknown mineral has a hardness of 5 or less. If they can scratch each other, then the unknown mineral has a hardness of 5. You will need to perform other tests to narrow down the hardness. If it is softer than apatite, try calcite, etc., etc until you have narrowed down the approximate hardness. Remember, this is a relative scale and a mineral that can scratch a mineral that has a hardness of 4.5 may be given a hardness of 5, but it still might be softer than apatite.

Hardness improvement test on [Touch SILC 5000](#) and [Touch SILC 5010](#)

Subject

To test the performance of [Touch SILC 5000](#) and [Touch SILC 5010](#) on hardness.

Materials

Substrate – Rubberwood Panel, size 20 X 28 cm
Type of Coating – Nitrocellulose clear sealer and lacquer for wood.
Application – Air pressure gun.

Coating system

PANEL A	PANEL B	PANEL C	PANEL D	PANEL E
Rubberwood panel	Rubberwood panel	Rubberwood panel	Rubberwood panel	Rubberwood panel
Light sand #240	Light sand #240	Light sand #240	Light sand #240	Light sand #240
NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base / Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup
Air dry, 1 to 2 hours	Air dry, 1 to 2 hours	Air dry, 1 to 2 hours	Air dry, 1 to 2 hours	Air dry, 1 to 2 hours
Sanding #240	Sanding #240	Sanding #240	Sanding #240	Sanding #240
NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup	NC sealer. Base/Thinner = 1/1 Spray viscosity at 14-16 sec. NK#2 cup
Air dry, 1 to 2 hours	Air dry, 1 to 2 hours	Air dry, 1 to 2 hours	Air dry, 1 to 2 hours	Air dry, 1 to 2 hours
Sanding #320	Sanding #320	Sanding #320	Sanding #320	Sanding #320
NC Clear Base/Thinner = 1/0.75 Spary viscosity at 16-18 sec. NK#2 cup	NC Clear (with 8% Silc 5000) Base/Thinner = 1/0.75 Spary viscosity at 16-18 sec. NK#2 cup	NC Clear (with 15% Silc 5000) Base/Thinner = 1/0.75 Spary viscosity at 16-18 sec. NK#2 cup	NC Clear (with 8% Silc 5010) Base/Thinner = 1/0.75 Spary viscosity at 16-18 sec. NK#2 cup	NC Clear (with 15% Silc 5010) Base/Thinner = 1/0.75 Spary viscosity at 16-18 sec. NK#2 cup

All panels above are left air dry overnight before the hardness test.

Test result

'Pencil Hardness ' test is a way to test the level of hardness of a coated panel by using pencil with different type of hardness (eg. 1B, 2B....up to 5H and 6H) and moving it on the panel at a constant 45 degree angle. This will be done continuously from 'soft' pencil and slowly increasing to a 'harder' pencil until a break on the coated film. To get a more detail information, please refer to ASTM standard.

Panel A – 2H

Panel B – 5H

Panel C – 6H

Panel D – 5H

Panel E – 6H

Please take note, the use of Touch Silc 5000 or 5010 to improve the hardness of the coating will also reduce (depend of the type of coating) the gloss level between 2 to 5 % but only minimum effect on the transparency (for clear system). That means, when using the 5000 series, the customer will be able to use less matting agent, which means cost saving plus maintaining the transparency of the product.