



Introduction of “Hard Strong” Toughened Glass Series Toyo-Sasaki Glass Co., Ltd



What is “HS”

“HS” stands for “Hard Strong”, is a Leading Brand of Toughened Glassware.

Over 50 Years Long Seller

Safety Focused

High Durability

Total Sales Exceeds 800 millions
*As of 2017

Dishwasher Safe

Made in Japan

The Principle of Glass Toughness

The glass toughness is basically determined by below factors.

1. Thickness of Rim Top:

The thicker they are, stronger they become.

Rim top is where tends to get the most impact, damage from everyday use.

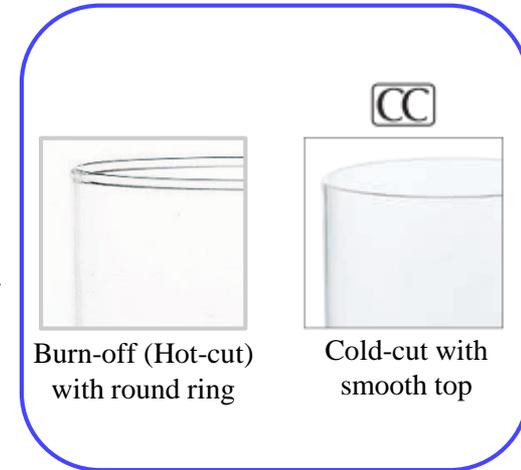
2. Rim Top Finish:

Burn-off (Hot-cut) finished glass is stronger than those cold-cut finished glass.

*Cold-cut: cutting off the rim by diamond cutter and finish with diamond file polish.

3. Composition of Glass:

Soda-lime glass is stronger than crystal glass containing metallic oxide.



From those different functional elements of each glass, as a result end up on differentiating the design and their best fitting dining scenes.



“HS” Range for Variety of Needs



HS Platinum



HS Gold



HS Blue



“Tough” and “Scratch Resistant”
Advanced HS series, thin in hand and light weight to carry. Suitable for high end dining, to be used in brand hotel and resorts.

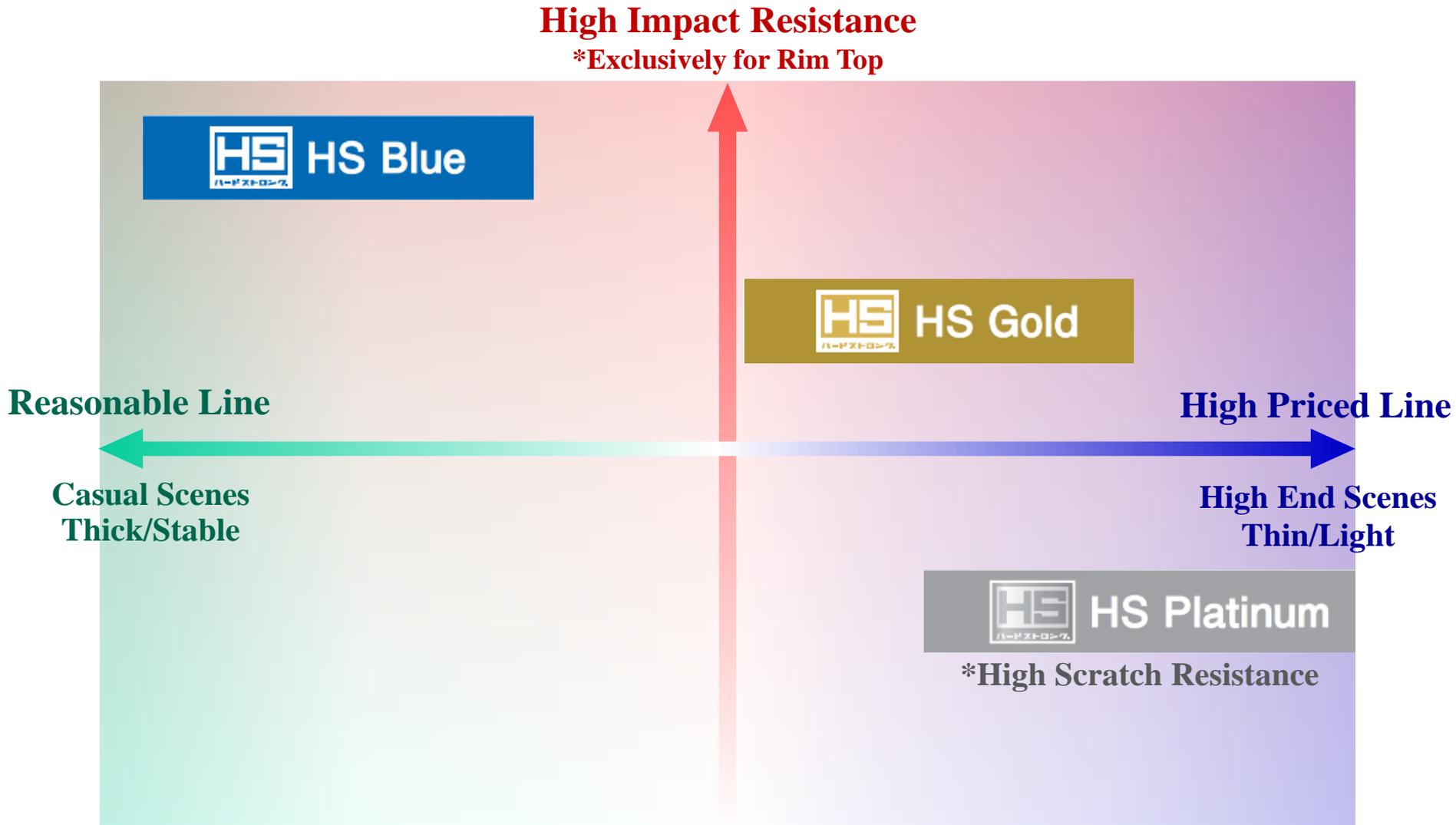


High-quality lineups to cover a wide range of food scenes.
Cold-cut processing with no ring around the glass-edge, smooth rim to enjoy drink directly.



Standard toughened glass with simple and classic design.
Loved worldwide, use for such as water tumblers. You likely to find them at Ramen shop in Japan.

“HS” Range at a glance



*May vary depending on the different piece of products.

“HS” Range Difference



HS Platinum



HS Gold



HS Blue

Design

Remarkably Thin and Light series
High-grade Hotels and Restaurants

Luxury design to fit
High-grade Hotels and Restaurants

At home, daily use
For Casual dining such as
Ramen shops in Japan

Strength

Full-Surface Toughened with
Ion Exchange Method

Top Edge Toughened with
Tempering Method

Top Edge Toughened with
Tempering Method
***Highest** impact resistance for
Rim Top

Thickness

Thickness of 1.1~1.4mm

Thickness of up to 1.6mm

Thickness of 1.8mm or above
***One of the reasons of its toughness.**

Rim Finish

Smooth rim by Cold-Cut process
Enjoy the taste of each beverage directly

Smooth rim by Cold-Cut process
Enjoy the taste of each beverage directly

Round rim by Burn-Off (Hot-Cut)

*May vary depending on the different piece of products.

“HS” Rim Top Thickness



HS Platinum

Smooth Rim Top
Cold-Cut
1.1~1.4mm



HS Blue

Round Rim Top
Burn-off (Hot-Cut)
1.8mm or above

*May vary depending on the different piece of products.

“HS” Range in Different Scenes



HS Platinum

Hotel



HS Gold

Restaurant



HS Blue

At Home



Bar

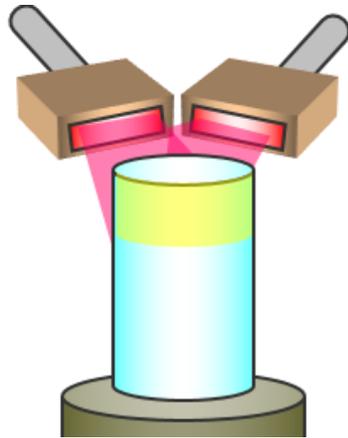


Casual Dinning



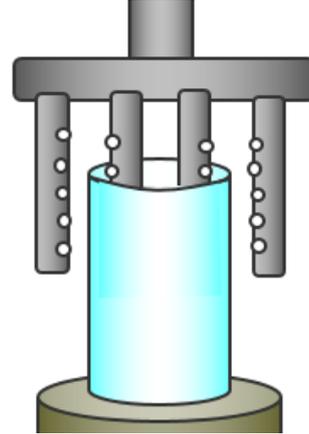
“HS BLUE” & “HS GOLD” Toughening Method

“HS BLUE” and “HS GOLD” series are toughened by **Tempering Method**



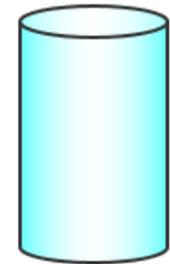
Heating

Glass expands while heating.



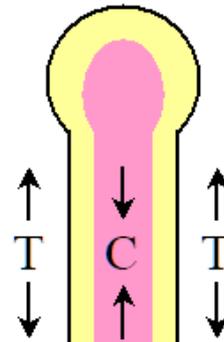
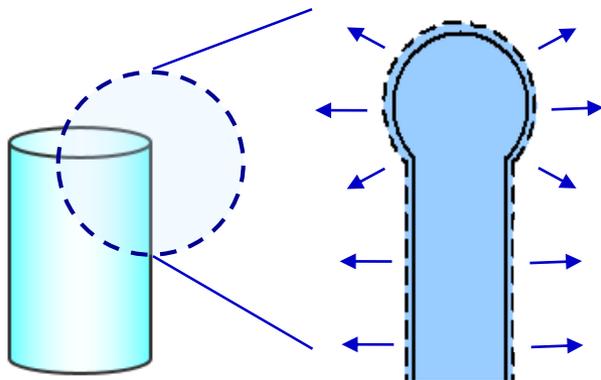
Quenching

As the outer surface been quenched they tries to shrink, however, as the inside stays hot, they generate power of **Tension**. On the other hand, inside generates **Compression** going against the expansion by heat.

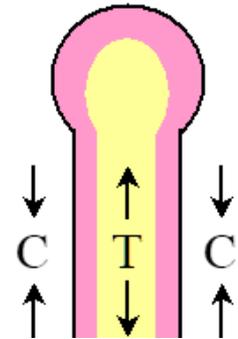


Finish

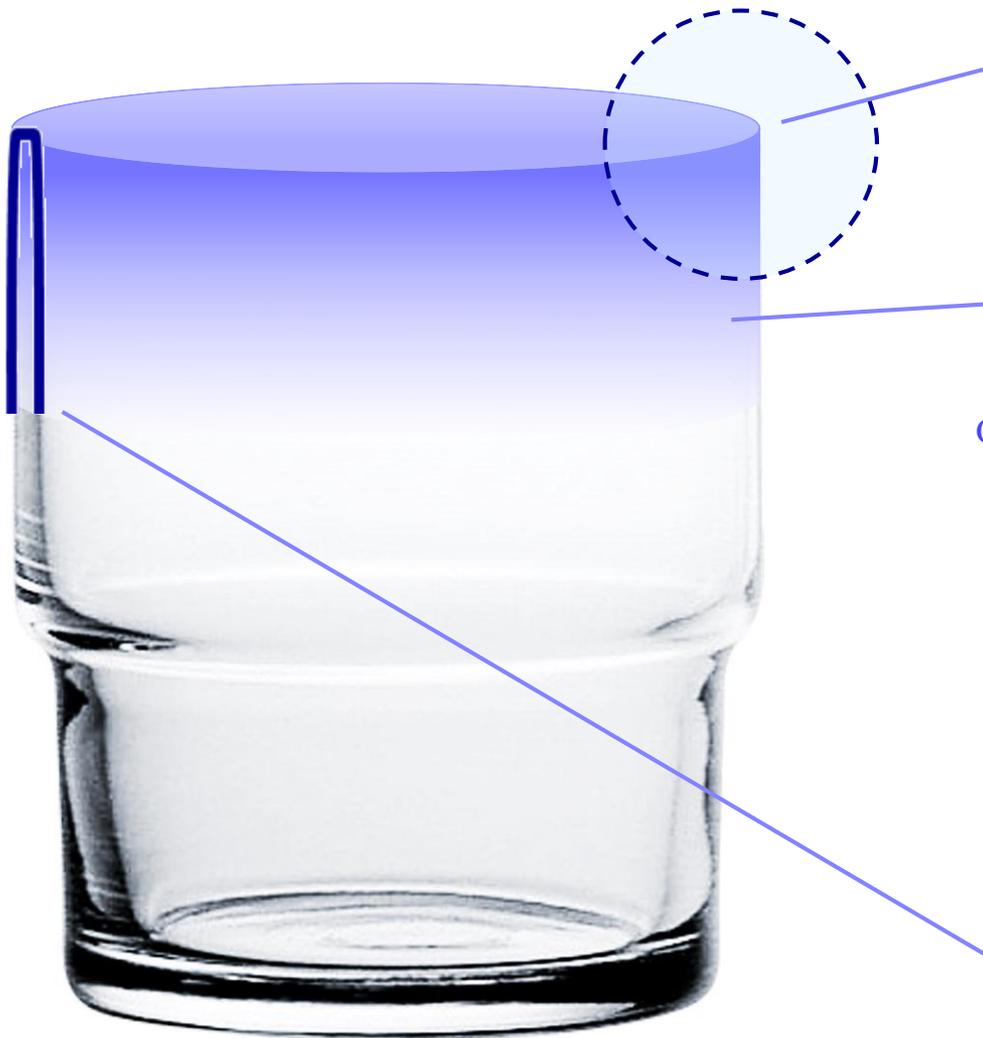
After total quench, the power reverse, and glass will be covered by **Compressive stress**, which toughens the glass.



Tension: Pulling Force
Compression: Pushing Force



“HS BLUE” & “HS GOLD” Toughened Area



Passing 3,000 times* stacking test.

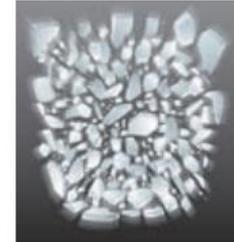


https://www.youtube.com/watch?v=g_gIMYXl4sM

Toughening (Heat) treatment applied on 10~30mm from the top rim, where they are most likely to get impact damage.

Q: Why no “Full Surface Tempered Toughened glass”?

A: As Full Surface Tempered Toughened glass may subject to abrupt and violent shattering/breakage, due to thick compressive stress layer.



Compressive Stress Layer is 0.3mm thick (about 1/6~1/5) and protects the glass from scratches and other impact for a prolonged period of time.

Representative HS Stackable Tumbler Item No.: 00345HS

*3,000 times stacking test is implemented for limited lines only.

“HS PLATINUM” Toughening Method

“HS PLATINUM” series are toughened by **Ion Exchange Method**

Its process is covering the surface of glass by exchanging ions of atoms consisting of glass on the surface.

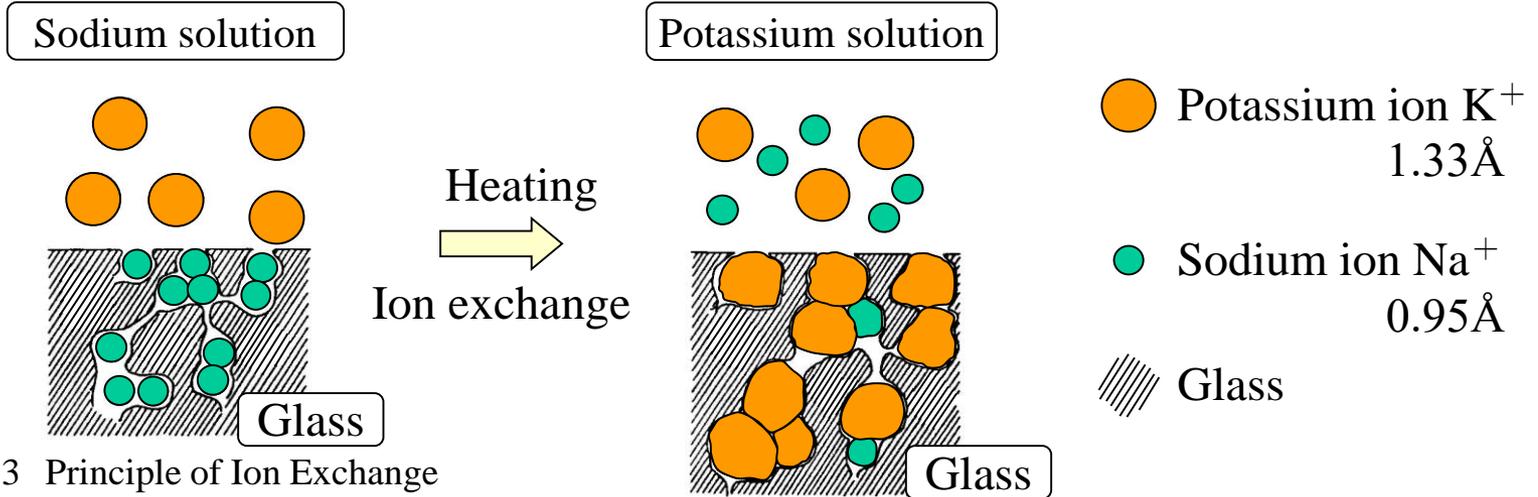
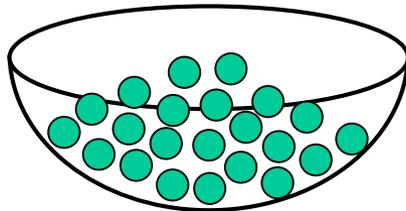


Fig. 3 Principle of Ion Exchange

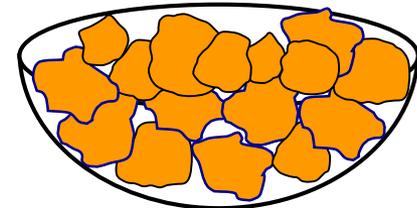
If you could imagine making a popcorn as like below...

● Sodium ion Na^+ 0.95Å



Before heating with oil, pieces of corn will not contact (touch) each other as they have enough space:
No Compressive Stress

● Potassium ion K^+ 1.33Å



Well made popcorns will contact (touch) each other as they have less space: **Compressive Stress Occurs**
⇒ Glass will be toughened by this Pushing Force

“HS PLATINUM” Impact Strength Test

The latest version of our “HS” series called as “HS PLATINUM” or in other words, “Ion Strong” provides two significant properties:

1. **Physical Impact Strength**
2. **Surface Durability**

1. Physical impact strength

– from the results of the industry standardized steel ball drop test (JIS S2043:2001) compared to our company products of item no. B-21108CS

Sample A with the latest version overall surface toughening was compared with Sample B without treatment in the test.

The test results revealed that the strength of A was increased by Ion Strong which is more than **1.6*** times as strong as B. The average height of the steel ball drop (till the sample breaks)

*As of 1st of July, year 2022.

| Test Results | A | B |
|----------------------------|---------------|---------------|
| Average of Ball Height(mm) | More than 440 | More than 240 |



<https://www.youtube.com/watch?v=jm73l0hXHq0>

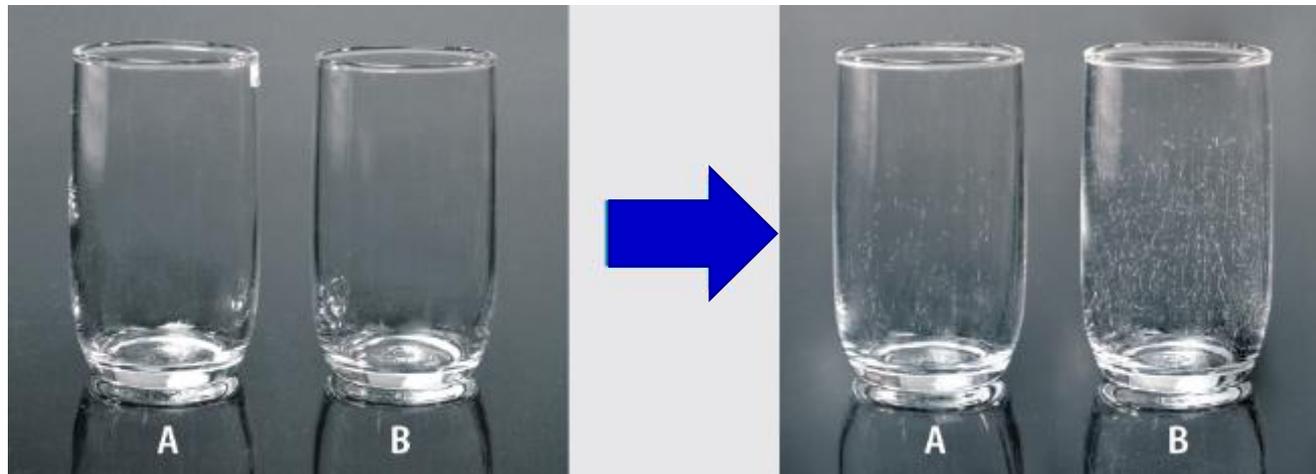
*May vary depending on the different piece of products.

“HS PLATINUM” Scratch Resistance Test

2. Surface durability

We experimented a practical use test at a city restaurant in Tokyo, Japan, for the purpose of reviewing the extent of surface corrosion when the glass was exposed to daily food-service operations such as frequent dishwashing, surface-to-surface contacts, etc. The following photos show the comparison.

Sample A: Latest version of overall surface ion toughening
Sample B: Without toughening treatment



After 1 month

No significant difference in surface corrosion between the two

After 24 month

The surface resistance against various kinds of surface damage is much more significant in Sample A than in Sample B.

This is also for while HS Blue and Gold have lower scratch resistance as they are toughened only for around the top rim, “HS Platinum” has strong resistance to small scratches as they are fully covered with the compressive stress layer.