

Color Reactions when Fusing with ARTISTA®

Anyone who melts a yellow glass together with a blue glass is looking to achieve a green color shade. In light of what the theory of colors tells us, this is what one should expect.

In this edition of ARTISTA® - News, we intend to discuss why these expectations cannot always be met. It should be pointed out up front that the seemingly abnormal behavior of many color glass combinations, due to the chemical nature of the glasses, by no means applies solely to the ARTISTA® product line.

Various mechanisms of change are known:

1. **Color changes caused by the effects of temperatures**
2. **Color changes caused by chemical reactions between copper and sulfur**
3. **Color changes caused by chemical reactions between sulfur and lead**

1. Effects of Temperature

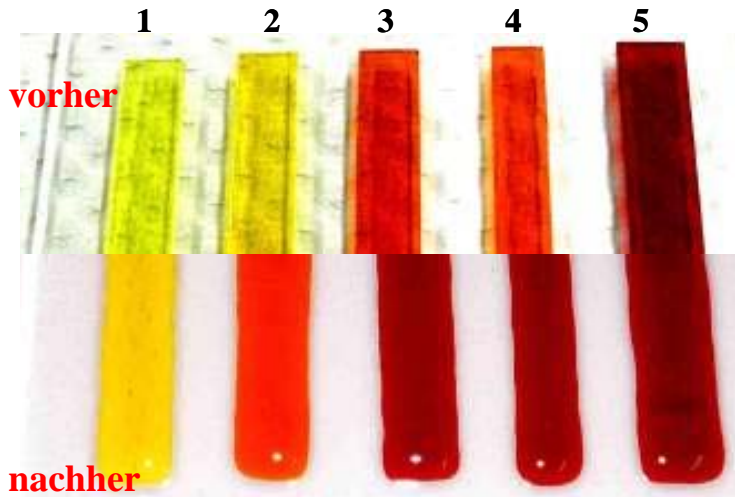
Typical colloidal colors such as yellow, orange and red, for example, change their light transmission based on the degree and duration of the effects of temperatures during the fusing process.

Glasses that contain selenium usually turn darker initially and become clouded in terms of their transparency, in response to longer soaking periods or after being subjected to higher temperatures. Under "normal" fusing conditions, slight individual opaque "clouds" may result.



Red 8110 and yellow 7184 cloud at 950°C (combing).

1. Effects of Temperature

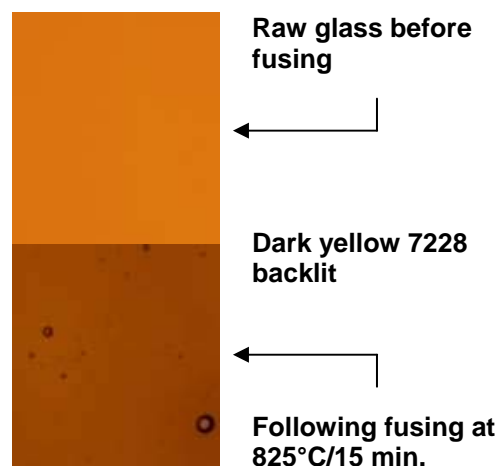


ARTISTA® Thin Glass before and after fusing.

With glasses that contain selenium, the color “ripens” during temperature treatments. The **cooling** of the glasses **during the manufacturing process** takes place too quickly for **colored colloids** to be formed.

Glass no. 2 can easily be interpreted as yellow and glasses no. 3 and 4 can easily be mistaken for orange.

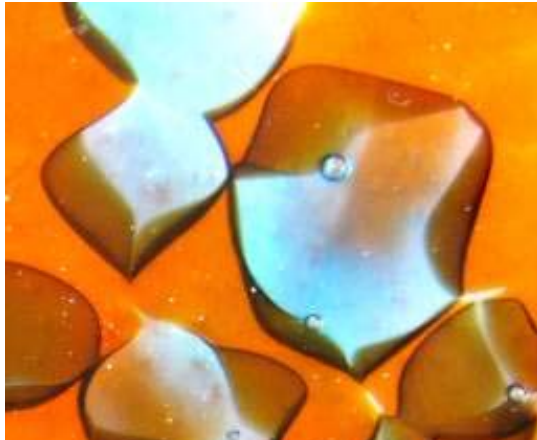
Dark yellow 7228, also a colloidal colored glass, loses approx. 10% of its transmittance as a result of the fusing process, yet remains transparent. Light yellow 7172 reacts in a similar manner. Nevertheless, it only darkens by around 5%.



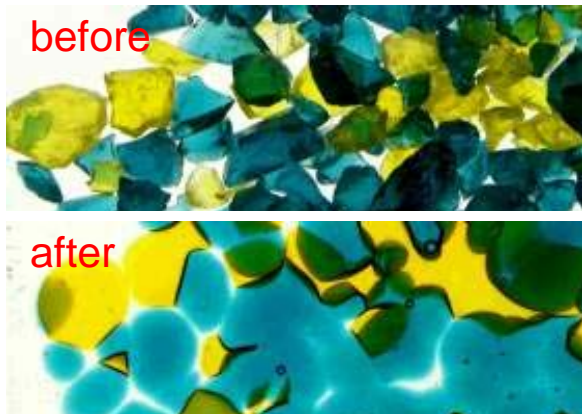
2. Changes in Color Caused by Chemical Reactions between Copper and Sulfur

Copper sulfide that exhibits a brown color shade forms at the **contact points** between glasses that contain copper and sulfur.

Generally, **blue glasses contain copper** and **selenium colored glasses contain sulfur**. However, sulfur is also used to manufacture “normal” yellow shades.



Frits orange 8047 in combination with blue 4264



Yellow frits (color 7184) mixed with blue frits (color 4032)

In certain cases, the phenomenon observed can even be **desirable**.

On the other hand, one can **intentionally** leverage them to achieve special **graphic effects**.

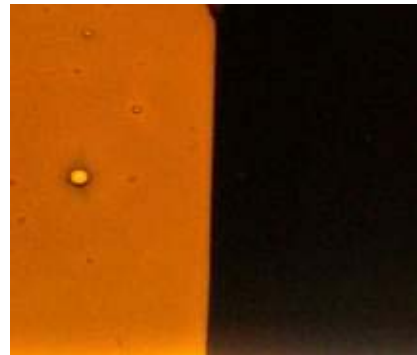
Experimenting and playing with the blue shades in conjunction with yellow, orange and red can certainly be a rewarding experience.

3. Changes in Color through Chemical Reactions between Sulfur and Lead

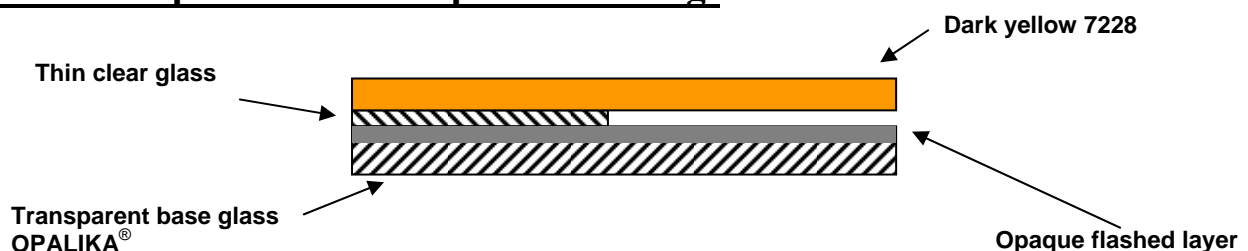
Black lead sulfide forms at the **contact points** between glasses that contain lead and sulfur.

The white flashed opal layer of OPALIKA® and commercially available **devitrification sprays** contain lead.

Dark yellow 7228 was fused together with the white flashed opal layer of OPALIKA®. On the left hand side, direct contact was prevented by using a clear glass intermediate layer. In this way, the typical color shade remains. On the right hand side, the zone that experienced direct contact, the glass has become black and opaque, due to exposure to **lead sulfide**.



Schematic Experimental set-up before fusing:



3. Changes in Color Caused by Chemical Reactions between Sulfur and Lead

Besides the fact that **ARTISTA®** is extremely stable with devitrification and there is, therefore, no need to use such products, **colors may react** to the use of commonly available **devitrification sprays** in glasses that contain lead.

The use of devitrification sprays is not recommended for the following reasons:

1. Covering low melting **lead glass** means these objects are unsuitable for use as **plates, cups, bowls etc.**, because one can expect toxic lead to be passed on to foods.

2. Surfaces treated with a **devitrification spray** differ significantly from the covered glass mass in terms of their **composition**. Frequent **contact with moisture** attacks this layer and can result in **lead being released**.

This **change in the surface** appears as **cloudiness**. Therefore, the enjoyment of glass used outdoors usually does not last very long.



Even the slightest amounts of lead contained in devitrification sprays, applied here using a paint brush, result in changes in the color of dark yellow 7228.

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