Haze vs BSDF

Application Note
Light Tec
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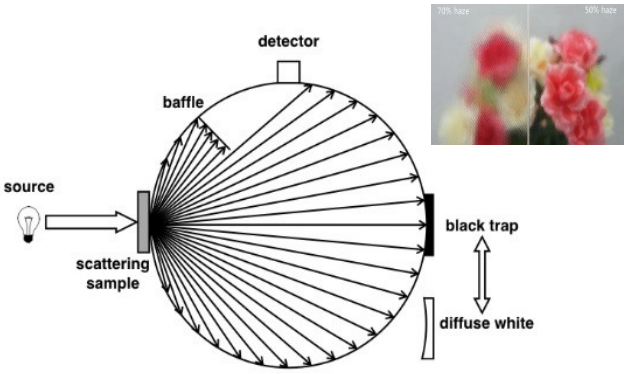
A diffusive material can be characterized by multiple quantities: transmission, absorption, TIS measurements, Haze, BSDF….
It is not always clear for a designer what is behind each of these terms. Especially what is the difference in between Haze and BSDF.

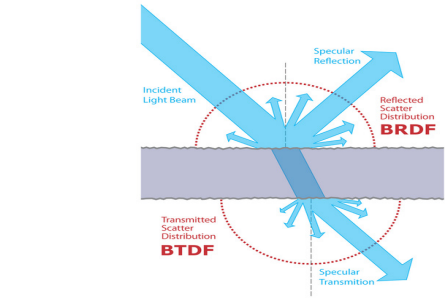


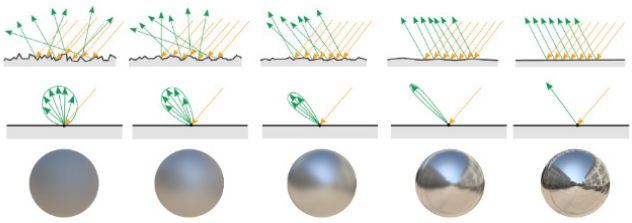
Come back to the fundamental: what is the definition of Haze and BSDF?

Haze is measured as the percentage of incident light scattered by more than 2.5° through a glass or plastic specimen. Haze has no specific unit. It is expressed in percentage, %. Haze gives no angular information in another words we do not know where the flux is going!

BSDF “Bidirectional scattering distribution function” is a goniophotometric measurement for the light scattering off and through the surface of a material.

BSDF can be separated into the reflected and transmitted components – BRDF (Bidirectional reflectance distribution function) and BTDF (Bidirectional transmittance distribution function). BSDF corresponds to the angular profile in transmission, reflection or both. On top of giving information on amount of transmitted or reflected light, it gives an additional information on where the light is going in the space.





By definition Transmittance and Reflectance values from a sample can be measured from BSDF. It is the integral of it on the complete sphere.

$$T_{TOT}(\theta_i,\varphi_i) = \int BTDF(\theta_d,\varphi_d,\theta_i,\varphi_i)\, d\Omega = \iint BTDF(\theta_d,\varphi_d,\theta_i,\varphi_i)\cos(\theta_d)\,|\sin(\theta_d)|\, d\theta_d\, d\varphi_d$$

This can be extrapolated to Haze computation if integrated θd between 2.5° and 90° and φd over 2π.

TEST CASE

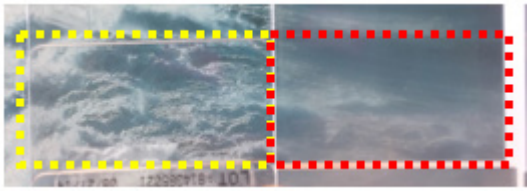
Benefit of BSDF

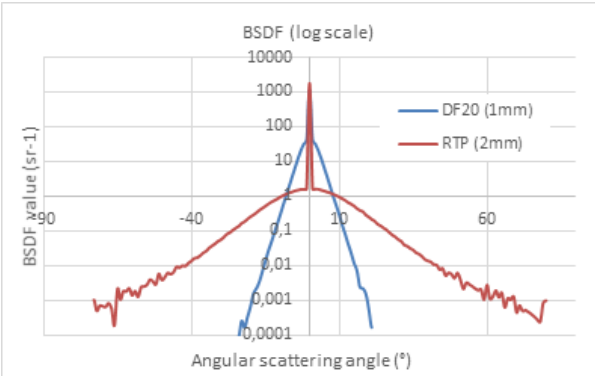
The problem with Haze is that it only gives a percentage of transmitted light. No information about angular direction of scattered light is given by Haze.

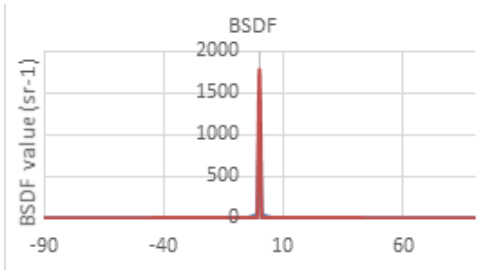
Therefore, several samples can have the same Haze value but can exhibit very different behavior.

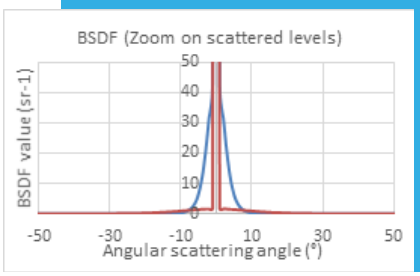
Let us consider 2 plastic samples available on the market:
-Evonik ACRYLITE Satinice DF20 (1mm thick) on the right -RT-P_0399x12952_B_SC_28141 (2mm thick) on the left

Both of them have a Haze ~35% ! But obviously they do not transmit light in an equivalent way!









From BSDF one can say that RTP sample is much more specular (clear) than DF20. Although global scattered light percentage (Haze) are identical between samples, RTP scatters at much lower levels but over the whole hemisphere (red curve), where DF sample scattering is mainly around specular direction, blurring the direct transmitted light (blue curve). These measurements were performed using Reflet 180S®.

Conclusion

We can clearly see the difference between two samples using BSDF (BTDF) where Haze could not. BSDF provides more information on the light propagation than Haze parameter.

Contact us for more information related to BSDF measurement.

Please visit our website to a find full description of our instruments Reflet 180S®, Mini-Diff V2® & Mini-Diff VPro®