

# Adapted White Color Formulations for Laser Welding of Whitegood Components

Sibylle Glaser

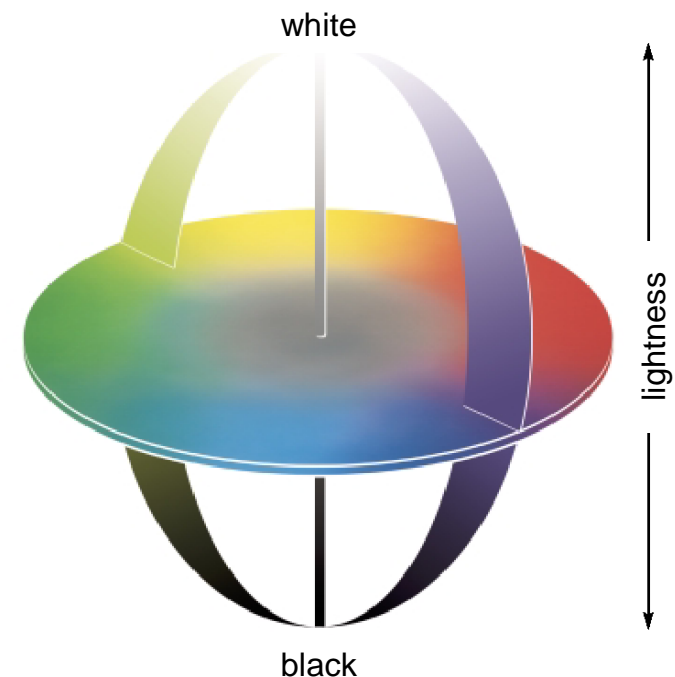
Treffert GmbH & Co.KG

- What is color?
- What are colorants?
- Laser welding of polymers
  - material
  - colorants – additives
  - Color combinations
  - Color combination white/white
- Conclusions

What is color?

# What is color?

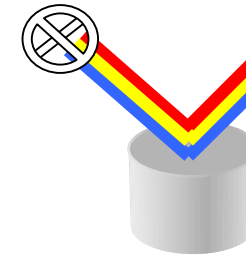
- In the range of 400 to 700 nm the electromagnetic waves are visible for the human eye.
- Illuminated objects reflect a fraction of the wavelengths spectrum of a light source which is detected by the eye and identified as color.
- Color is an individual perception which is stimulated by light received by the eye.
- The observed color is influenced by the light source.



Source: X-Rite

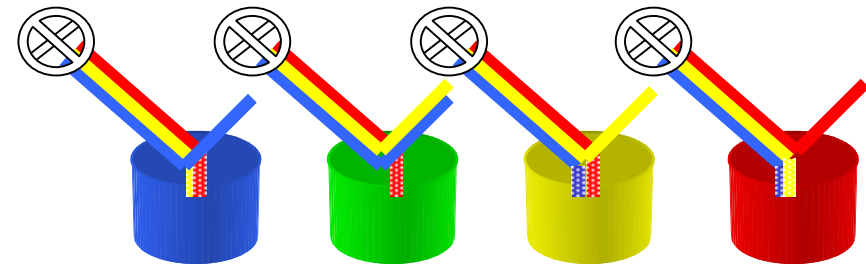
## Color white

Total reflection of visible light  
=> no light absorption or transmission



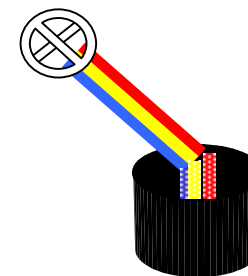
## Colors

Different reflection of visible light (depending on light source)



## Color black

Total absorption of light  
=> no light reflection or transmission



# Colorants

# Classification of colorants

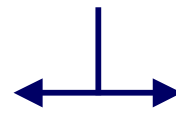
## Colorants

### Dyes

soluble in plastics



organic



### Pigments

insoluble in plastics



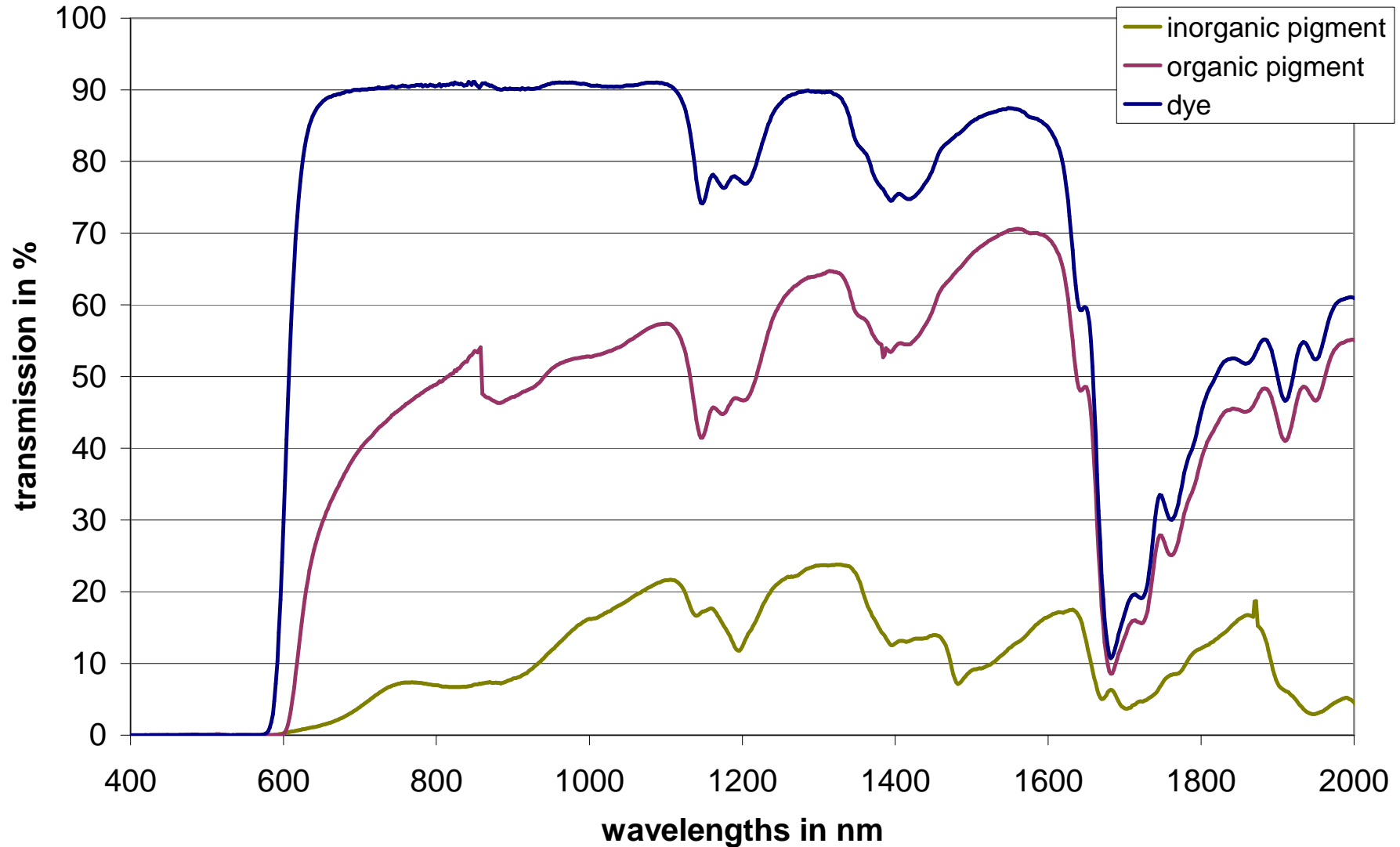
organic



inorganic

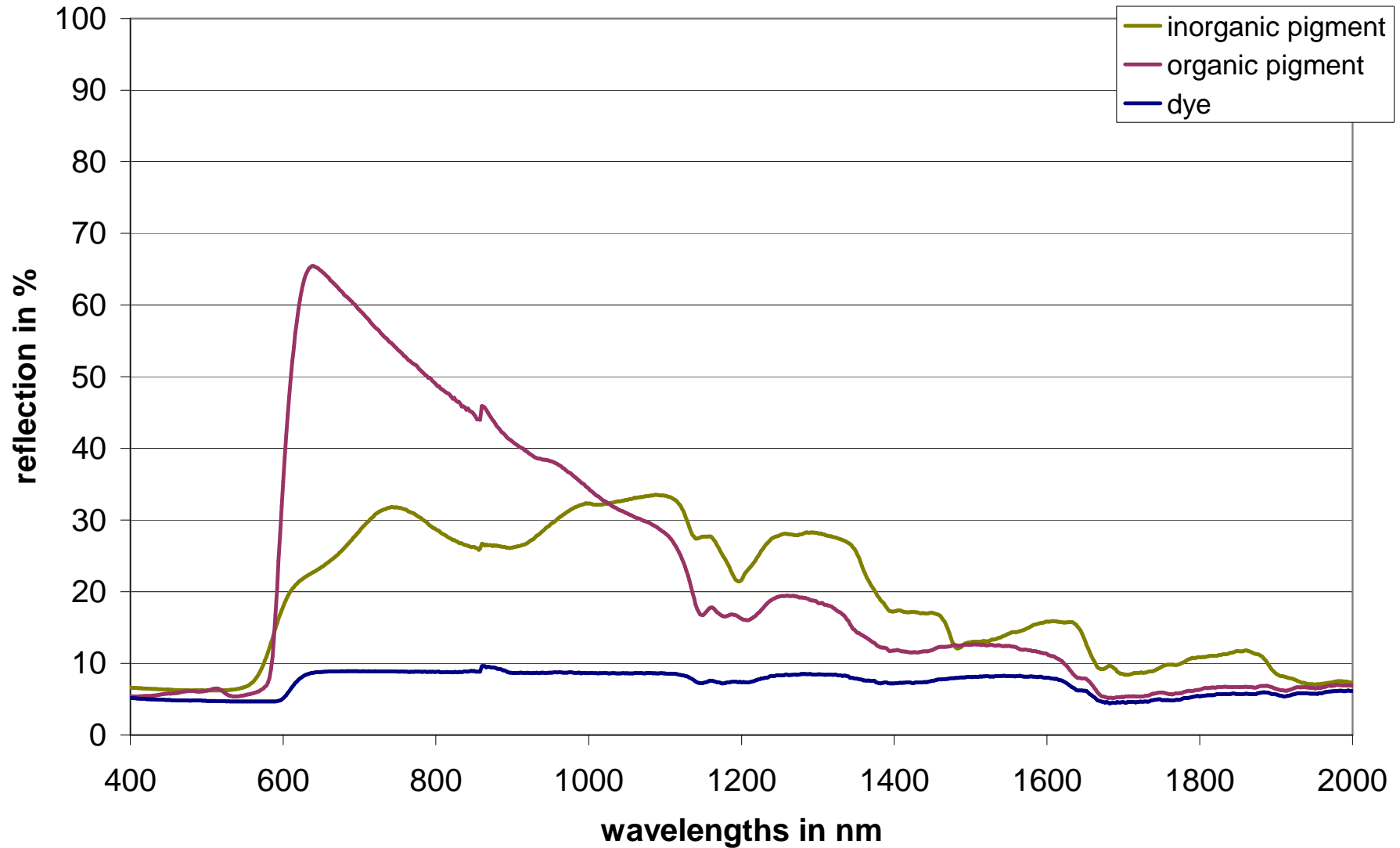


# Influence on laser welding

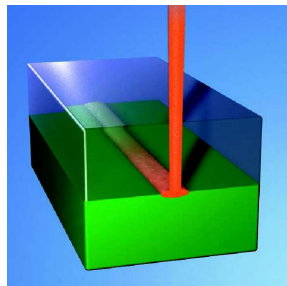




# Influence on laser welding

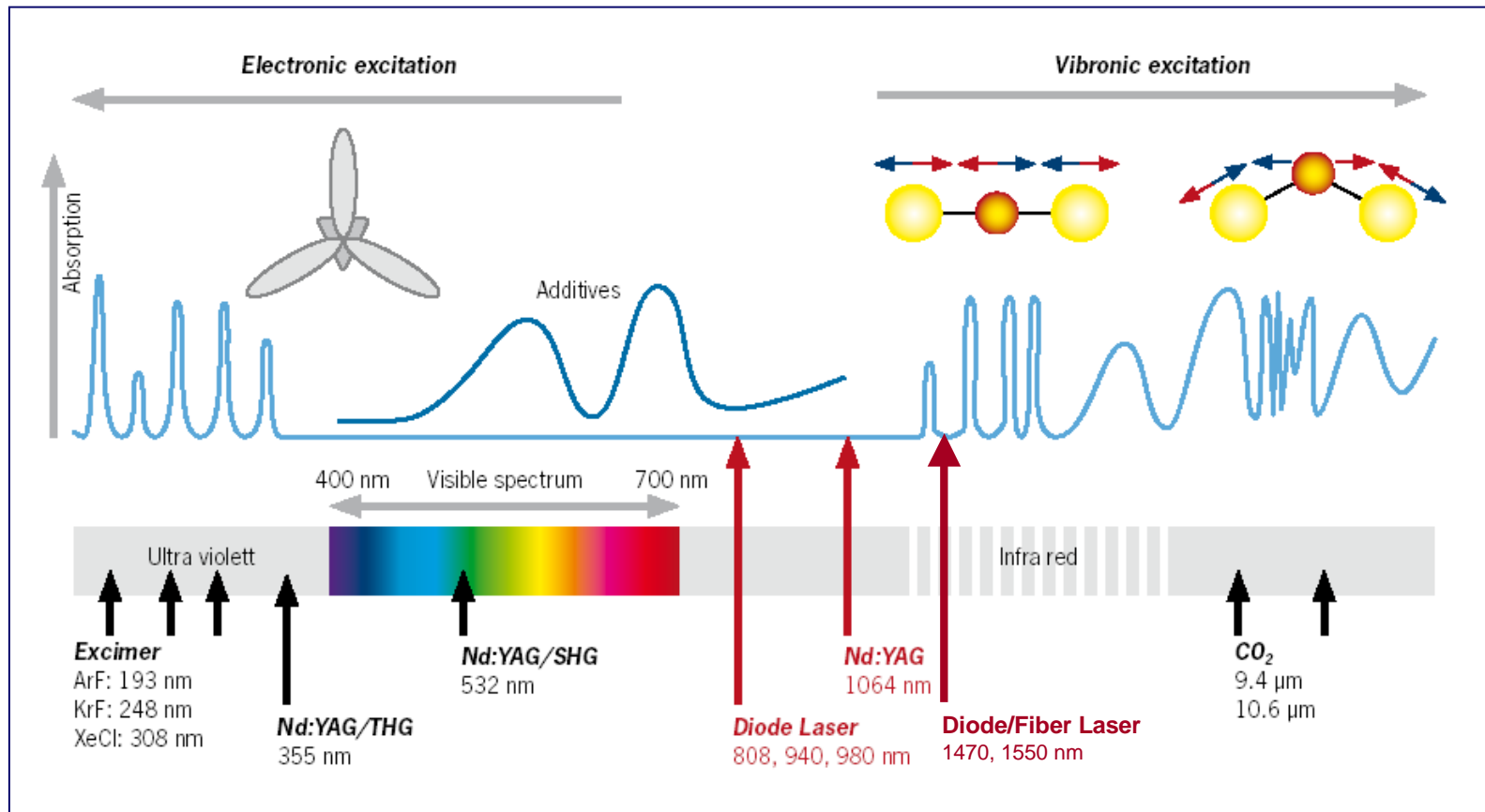


# Laser welding of polymers



material

# Absorption range of polymers



# Optical properties of thermoplastics

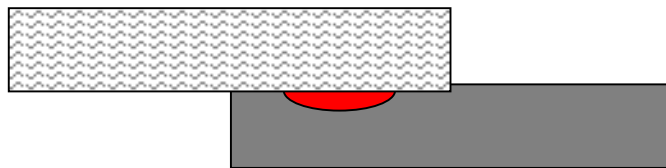
Behaviour of thermoplastics in regard to light in the visible and the NIR range:

- transmission
  - scattering
  - reflection
  - absorption
- 
- depending on wavelength and wall thickness

# Laser welding of polymers

## Colorants - Additives

**laser transparent**



**laser absorbing**

# Requirements for the coloring of the joint partner

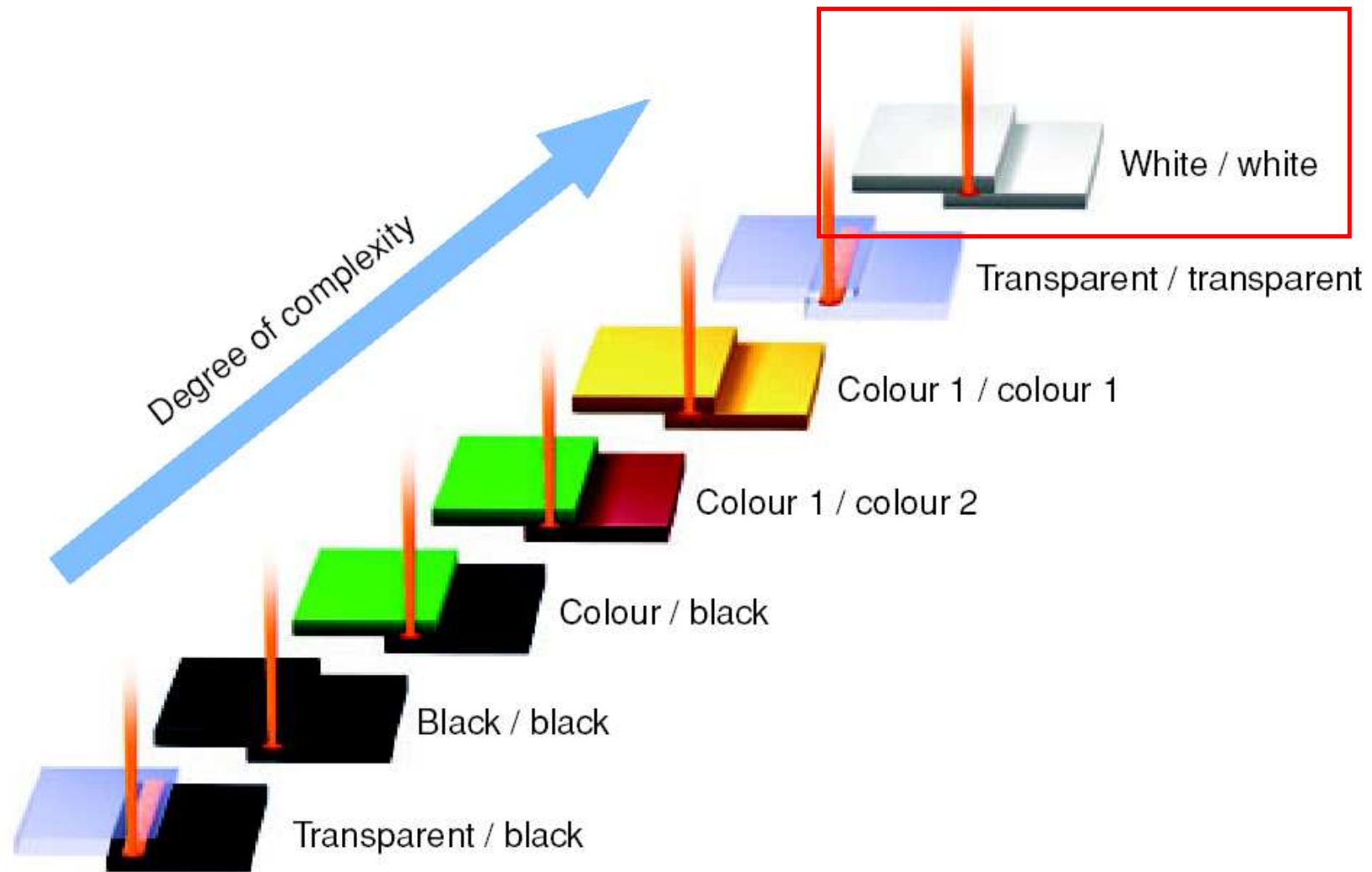
## **laser transparent**

- Colorants should influence the NIR light as little as possible.
- Defined colors are created using colorants.
- Linking of the color in the visible and the function in the NIR-range.

## **laser absorbing**

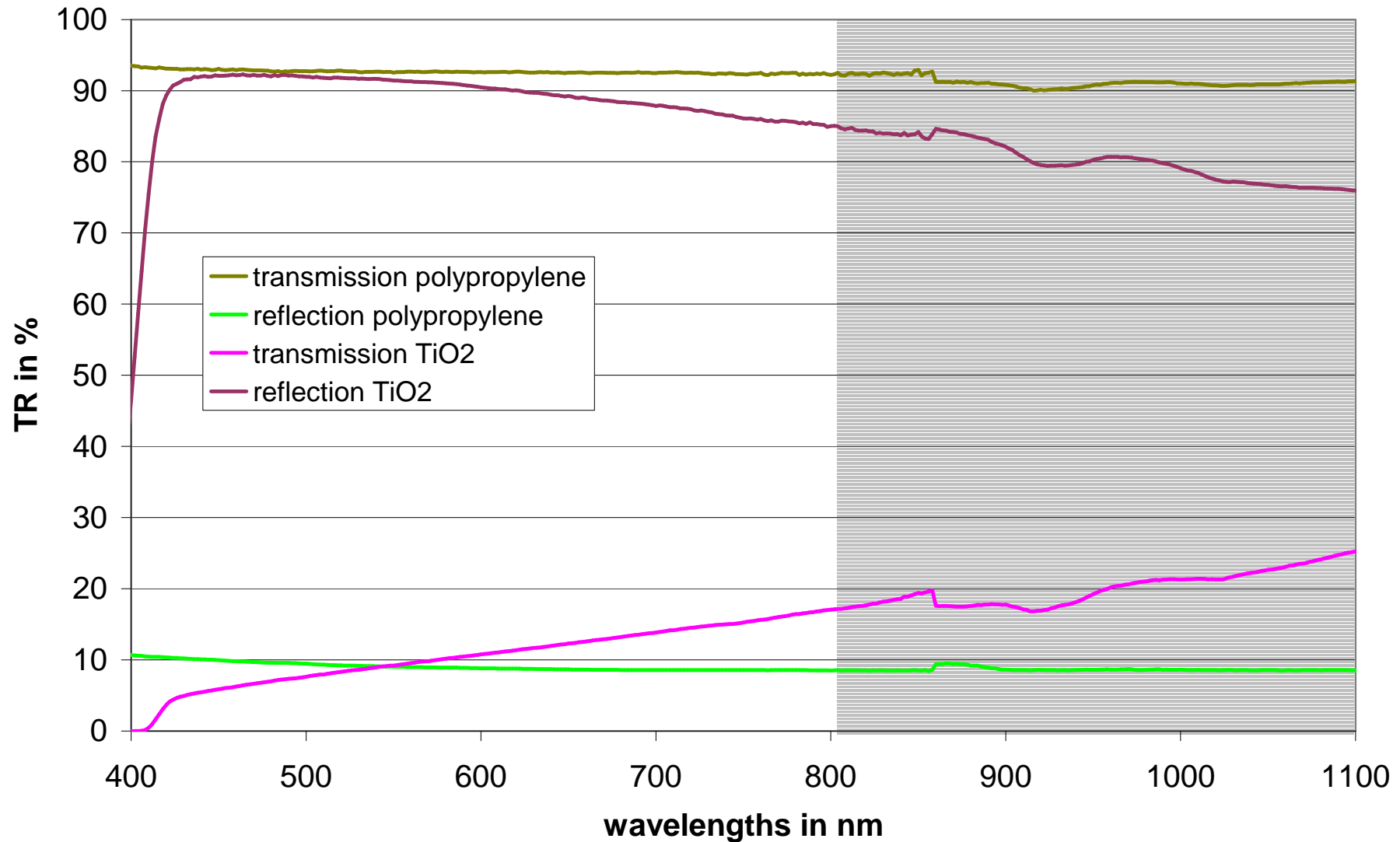
- Colorants respectively additives absorb the NIR-light and change it effectively into heat energy.
- Defined colors are created using colorants.
- Linking of the color in the visible and the function in the NIR-range.

# Color combinations



# White / White

# 800 – 1100 nm





White / White

800 – 1100 nm

### Laser absorbing part:

By use of color neutral NIR absorber a signal white (RAL 9003) is possible.

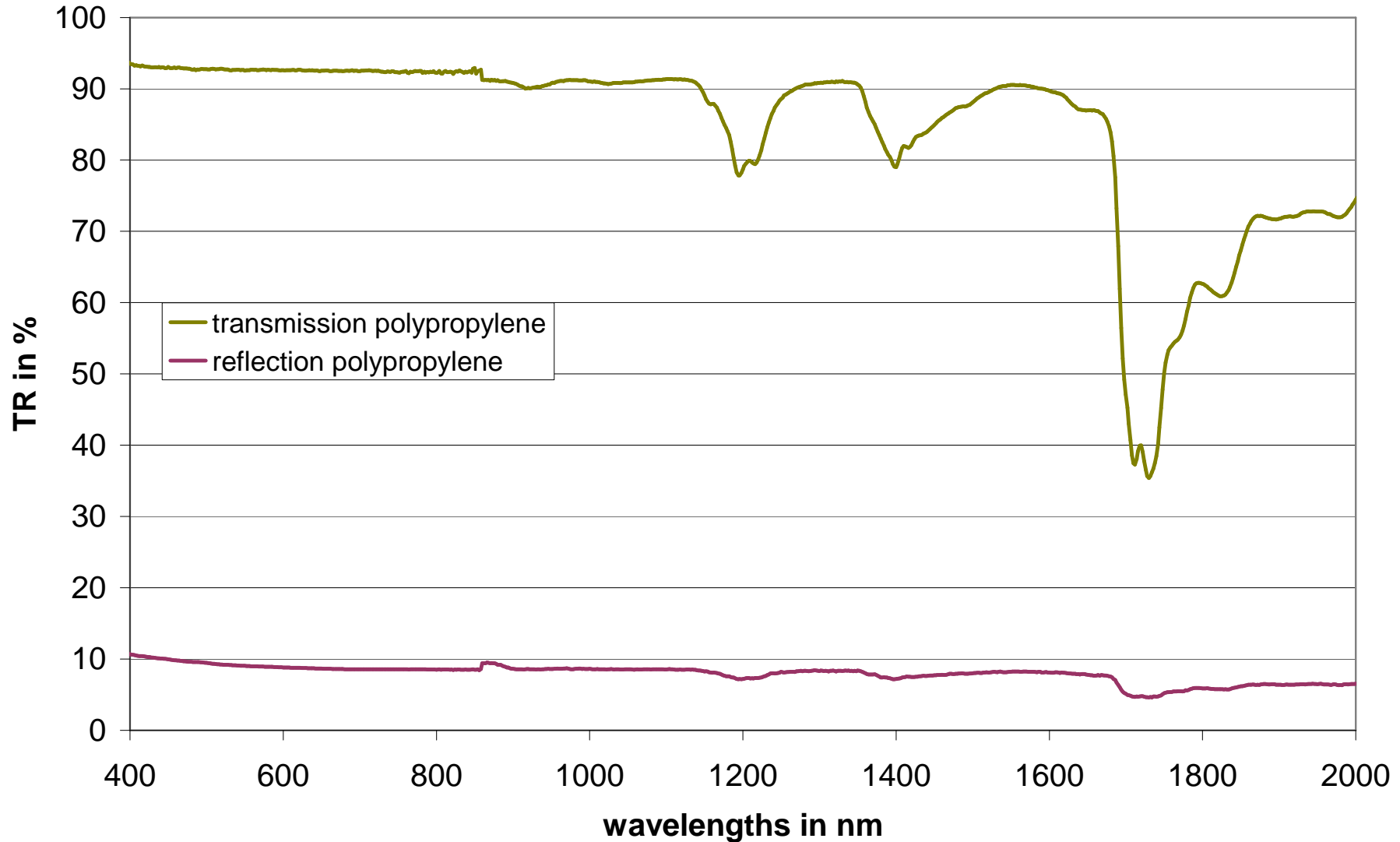
### Laser transparent part:

#### Challenge

- ⇒ high reflection
- ⇒ transmissive scattering
- ⇒ adjustment milky translucent

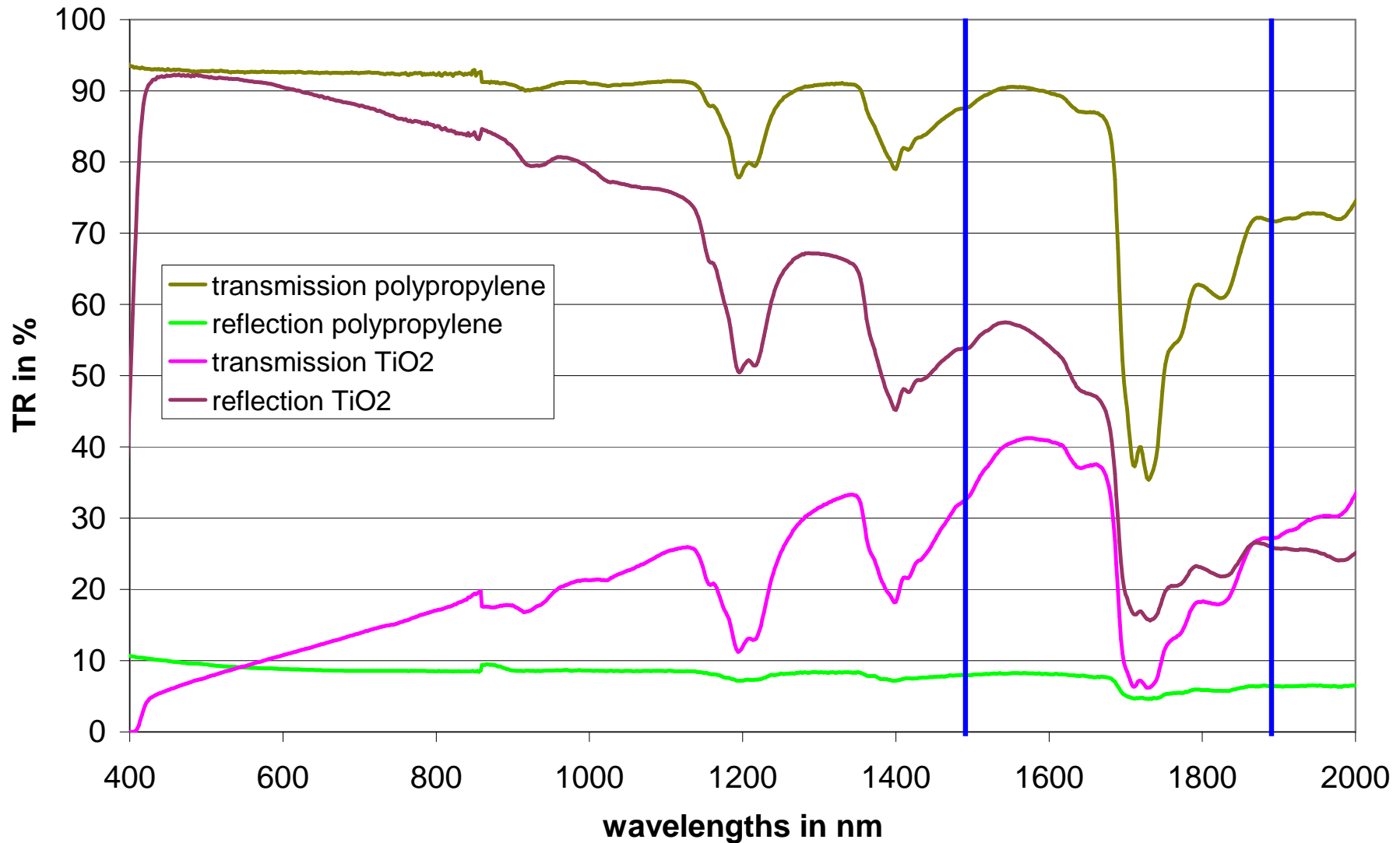


# Uncolored polymer - polypropylene



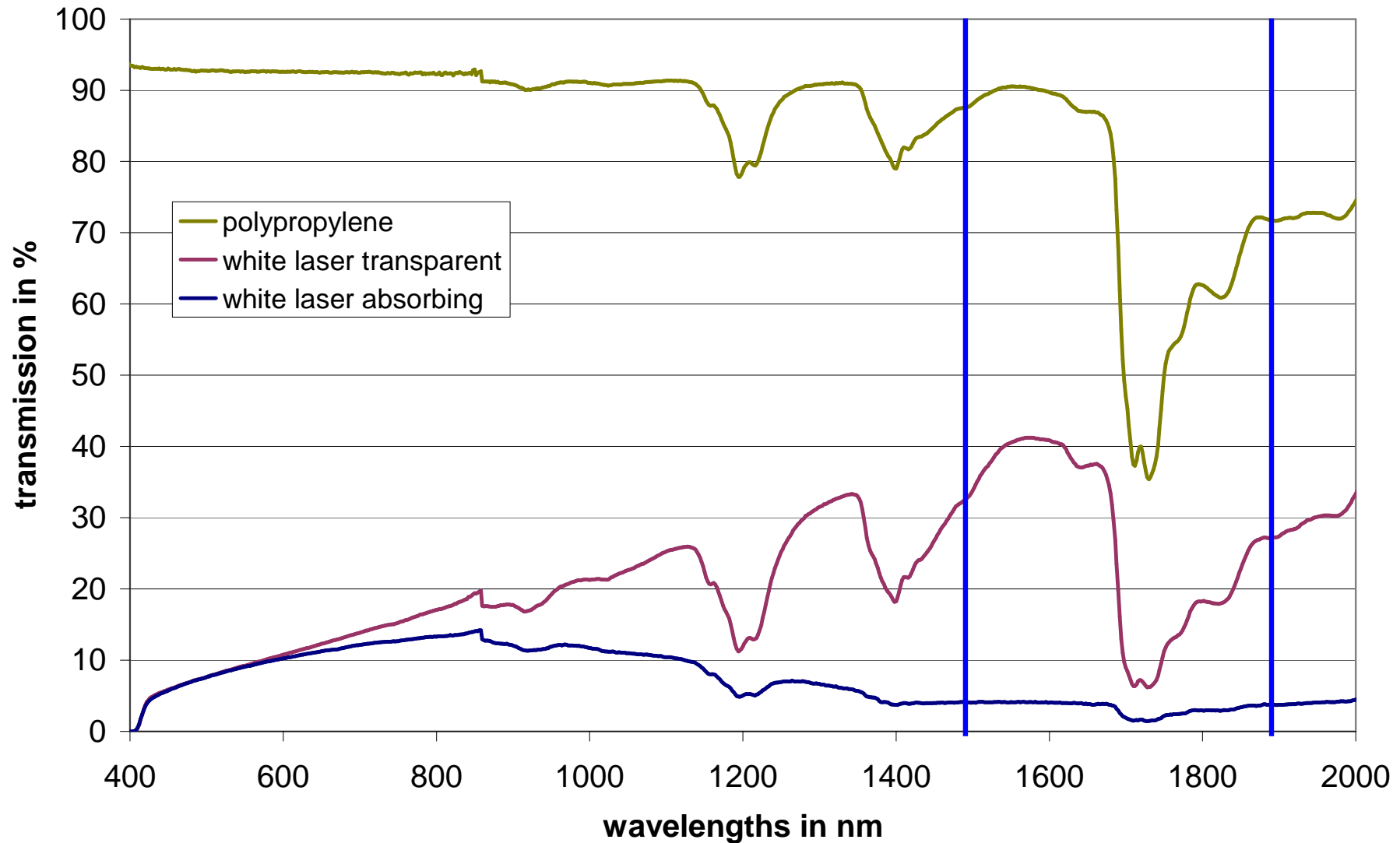
# White / White

# ~ 1500 nm / 1900 nm



# White / White

# ~ 1500 nm / 1900 nm



White / White

~ 1500 nm / 1900 nm

## Laser absorbing part:

### Challenge

⇒ NIR-absorber with enough absorption and with nearly no colour for a laser absorbing weldable white

## Laser transparent part:

By use of selected laser wavelengths the transmission of opaque white should be sufficient.

# Conclusion

- Laser welding of white laser transparent on white laser absorbing parts with the same color is now possible.
- Knowledge about spectral data of colorants and absorber additives are essential for the formulation of NIR transparent and absorbing colours.
- By using higher laser wavelengths, the number of weldable color combinations increase.
- Possible applications are:
  - whitegoods
  - medical devices

Thank you for your  
attention!



Treffert GmbH & Co. KG

In der Weide 17

D-55411 Bingen

[www.treffert.org](http://www.treffert.org)

Sibylle Glaser

+49 (0) 6721 403 0

[sibylle.glaser@treffert.org](mailto:sibylle.glaser@treffert.org)