

Temperature effects of PTFE diffusers

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Davos

PTFE, Poly(tetrafluoroethylene) Teflon[®]

- the most commonly used diffuser material
(in UV measurements)
- nonpolar polymer, main chain $[\text{CF}_2\text{-CF}_2\text{-}]_n$
- reversible crystal structure changes at 19 °C and 30 °C

Tested diffusers

- Schreder UV-J1002, dome, thickness 2.5 mm
- Schreder UV-J1003, identical to UV-J1002
- Bentham D5, planar, thickness 0.6 mm
- PTFE diffuser from Optronic 742, dome, thickness 0.2 mm
- quartz diffuser from Optronic 742, planar

Test set-up at STUK

- diffuser placed inside of a weather-chamber
- 1kW FEL as light source
- temperature range from -10 °C to 45 °C
- Bentham DM 150 spectroradiometer, 300 nm - 400 nm

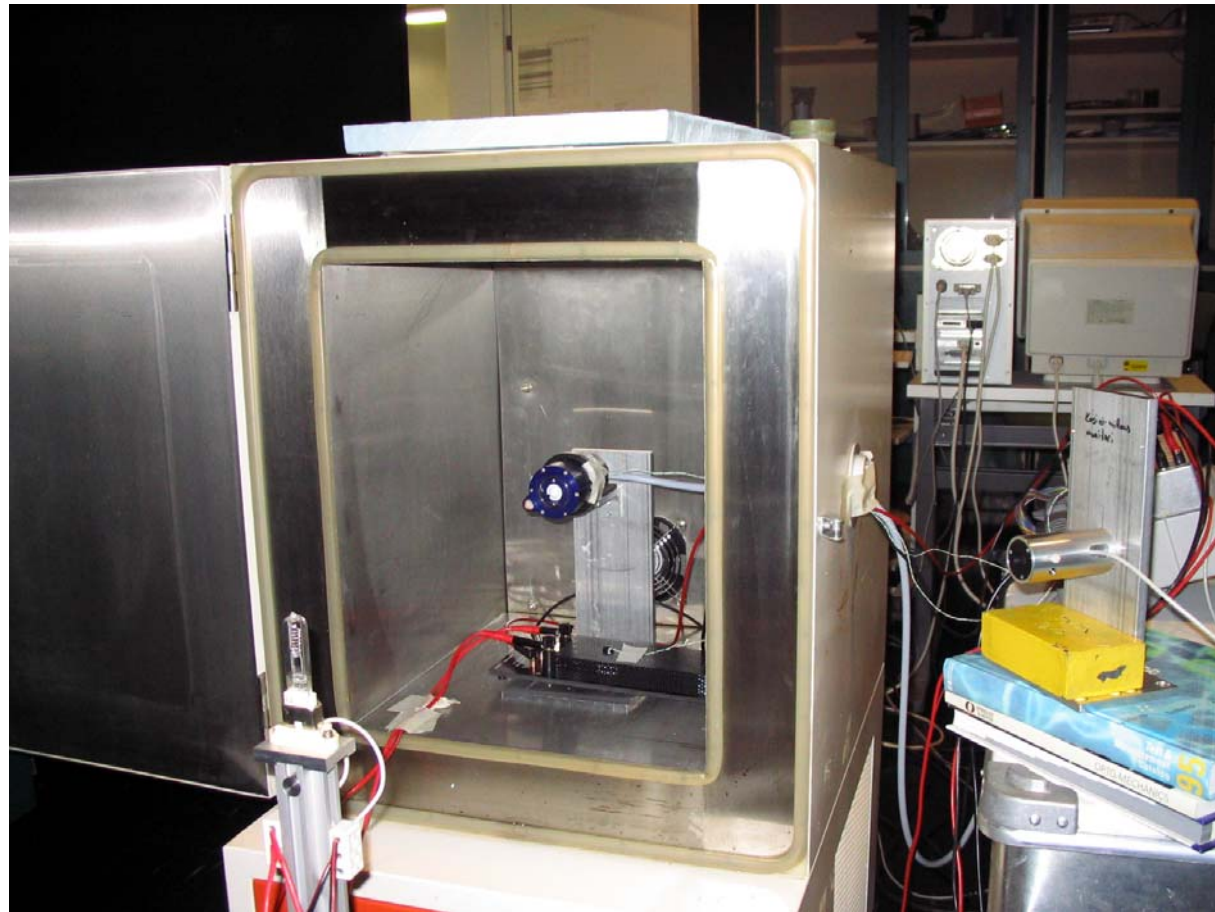
Test set-up at CMS

- laboratory temperature regulated, diffuser heated
- 1kW tungsten halogen lamp as light source
- temperature range from 13 °C to 44 °C
- Bentham DM 150 spectroradiometer, 280 nm - 600 nm

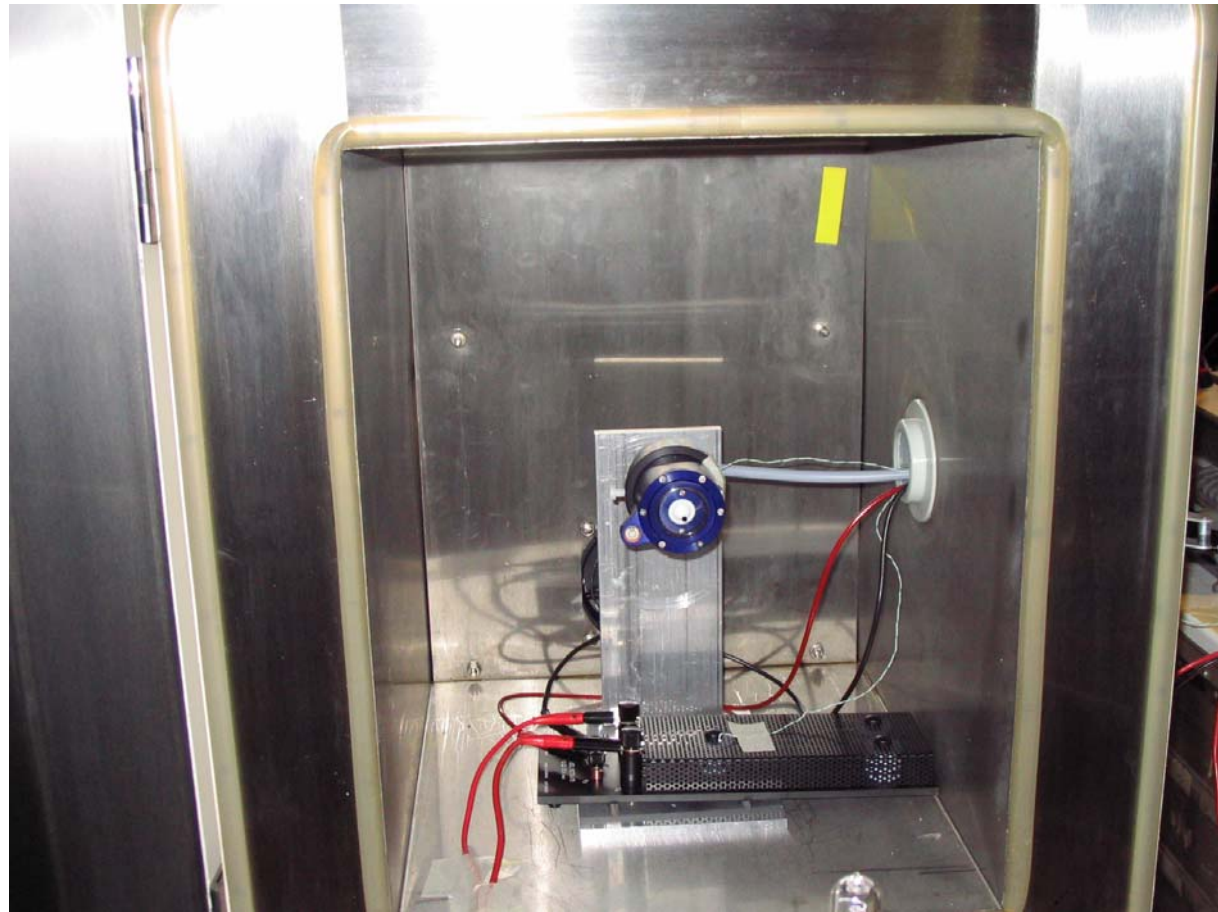
Test set-up at STUK



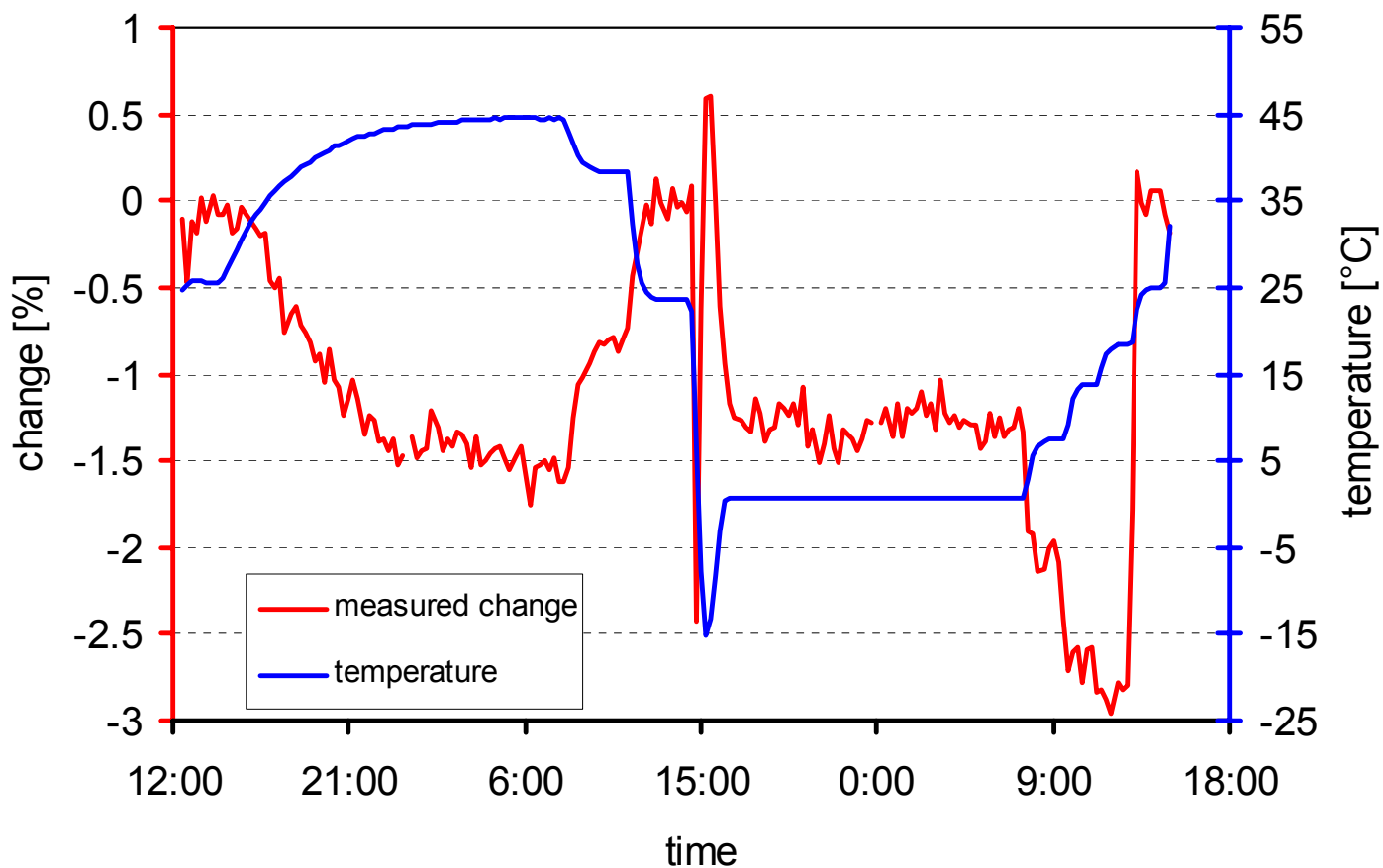
General lay-out



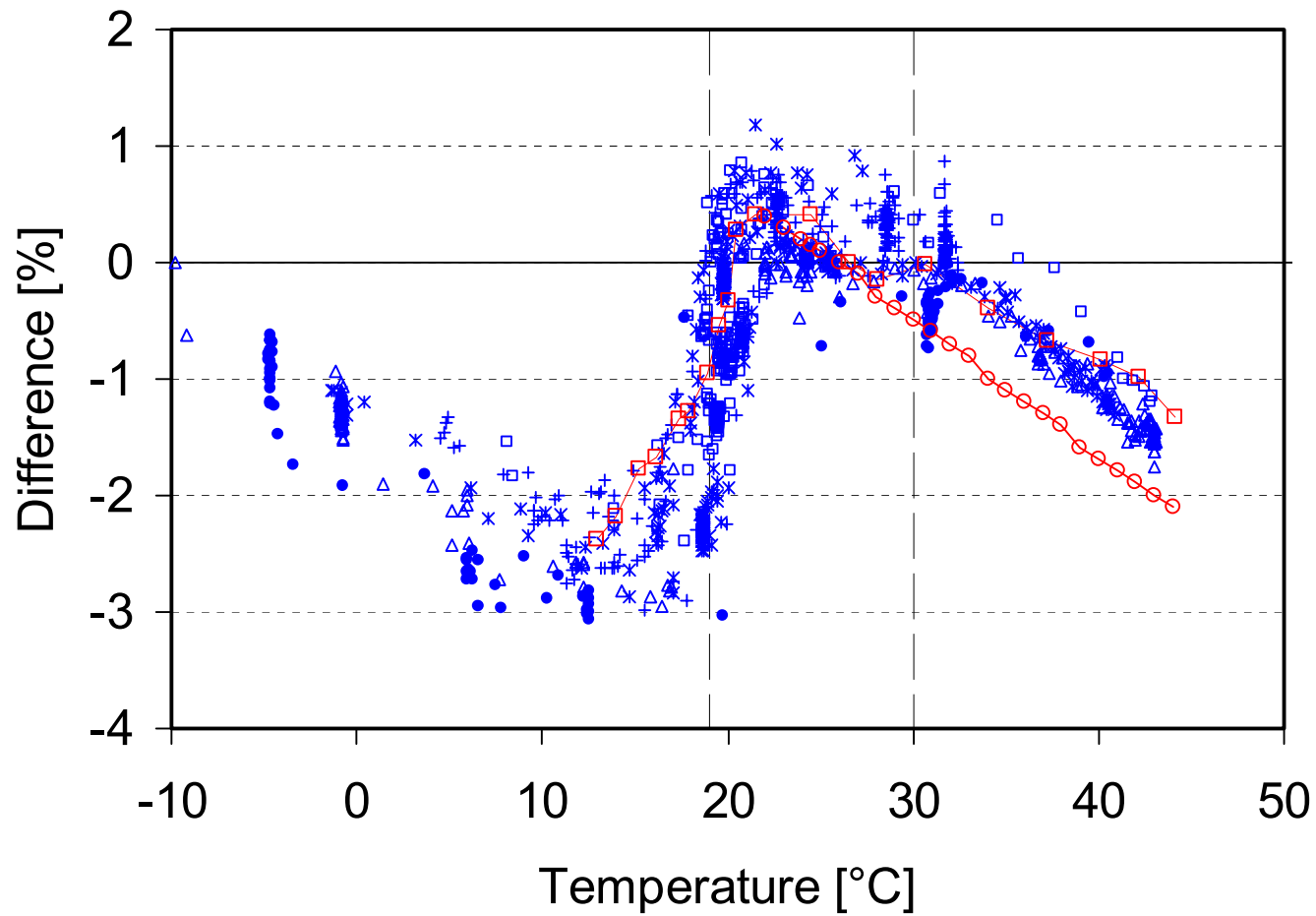
Inside the weather chamber



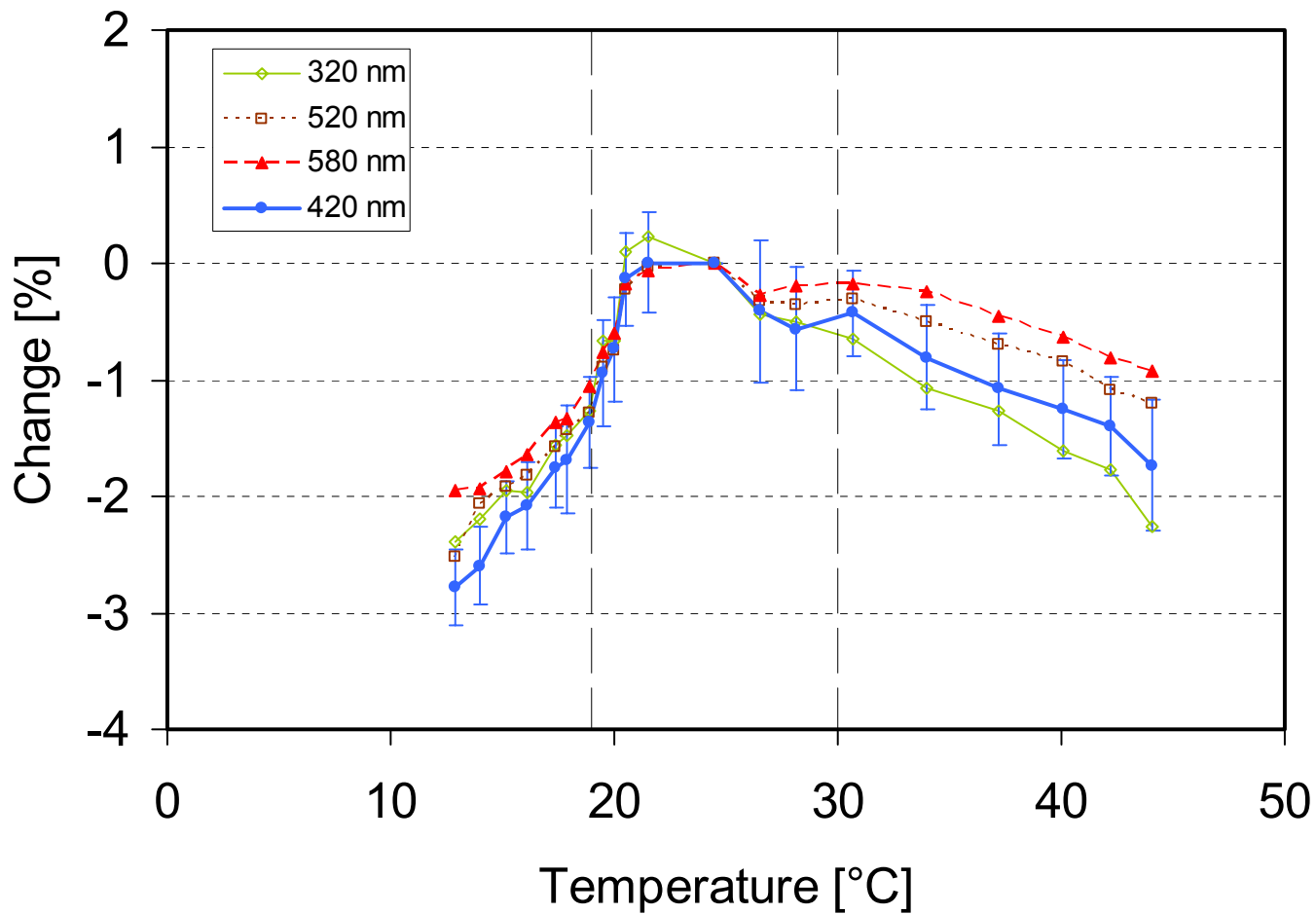
Test run example, UV-J1002



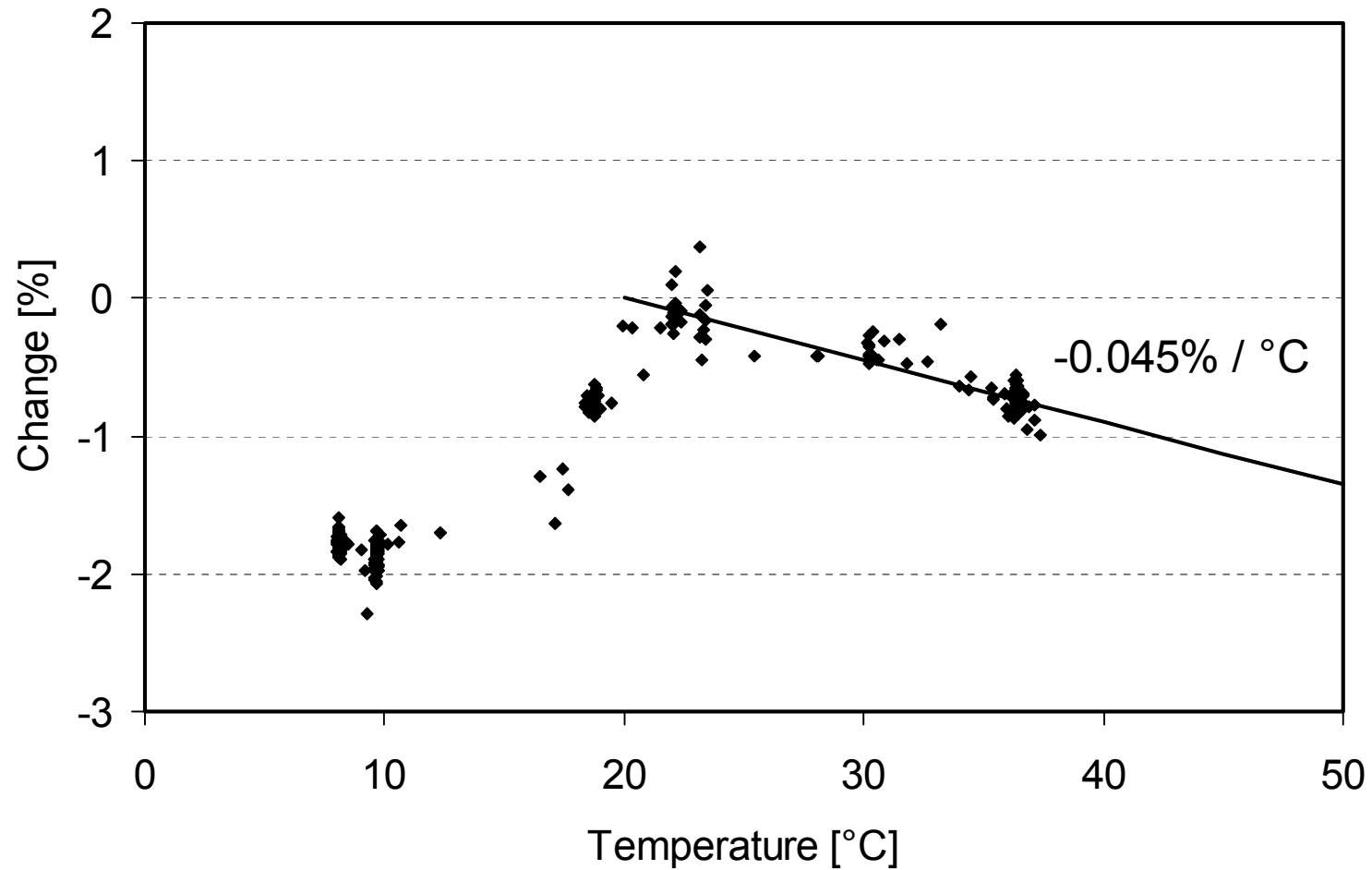
Schreder UV-J1002



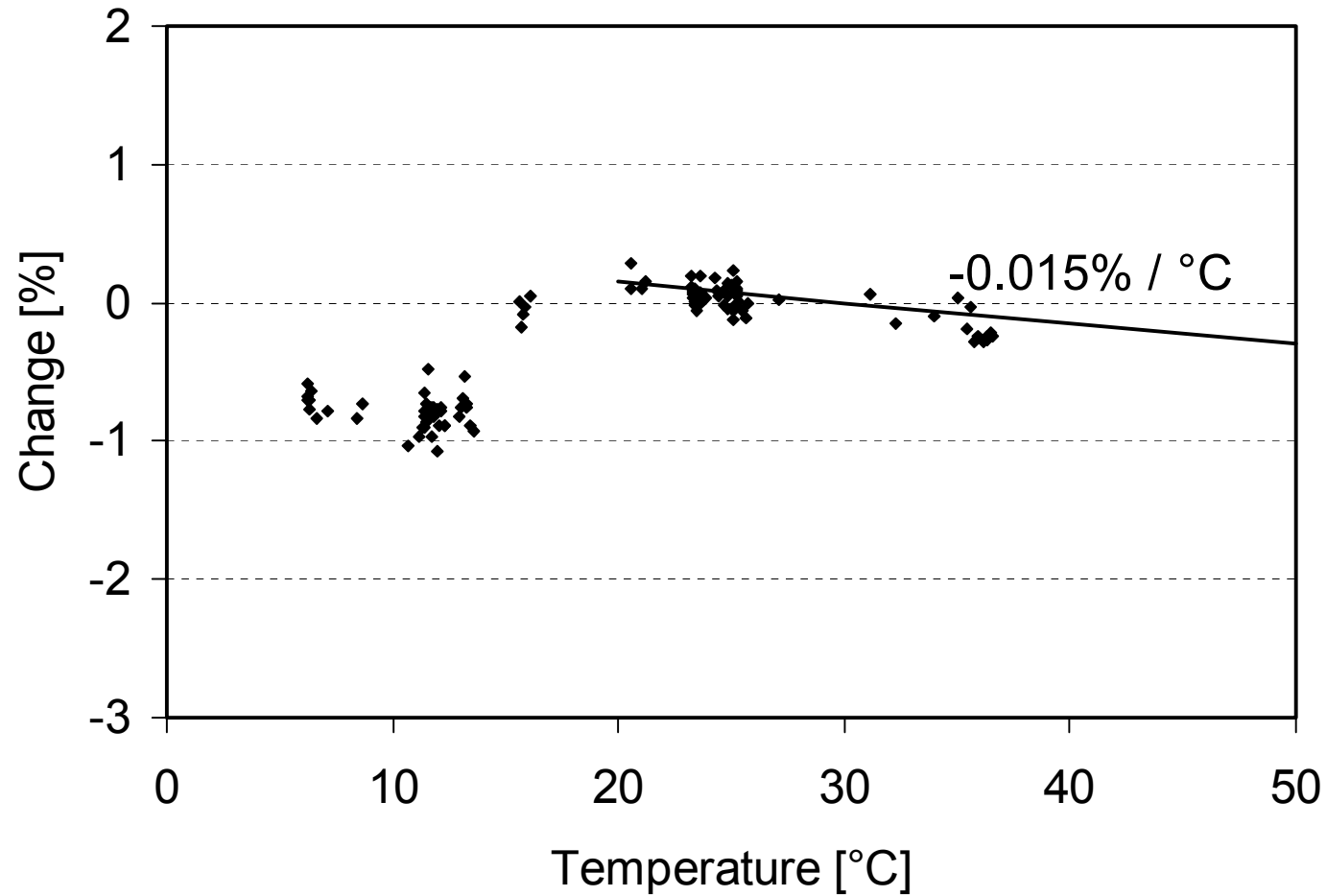
Schreder UV-J1002 λ - dependency



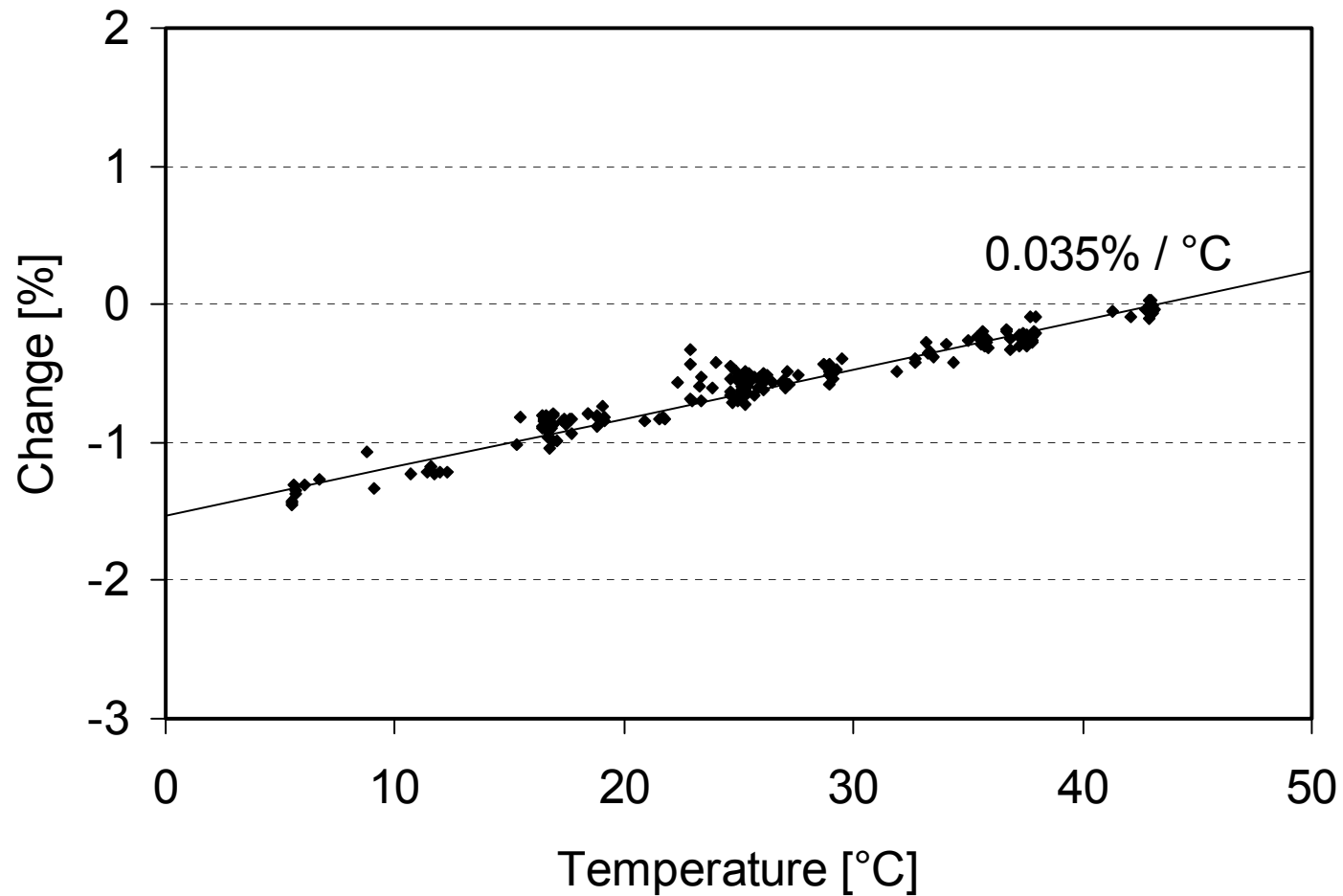
Bentham D5



Optronic PTFE diffuser



Optronic quartz diffuser



Conclusions

- Transmission change up to 0.1% / 1 °C
- Up to 3% change at 19 °C
- Small wavelength dependency at over 27 °C temperatures
- The magnitude of the temperature effects depend on the diffuser type; type of PTFE and thickness

Publications

- Ylianttila L. and J. Schreder, Temperature effects of PTFE diffusers, *Optical Materials*, 32, 1811-1814, 2005
- McKenzie, R., J. Badosa, M. Kotkamp, and P. Johnston (2005), Effects of the temperature dependence in PTFE diffusers on observed UV irradiances, *Geophys. Res. Lett.*, 32, L06808, doi:10.1029/2004GL022268, 2005