

News on glues at June '99

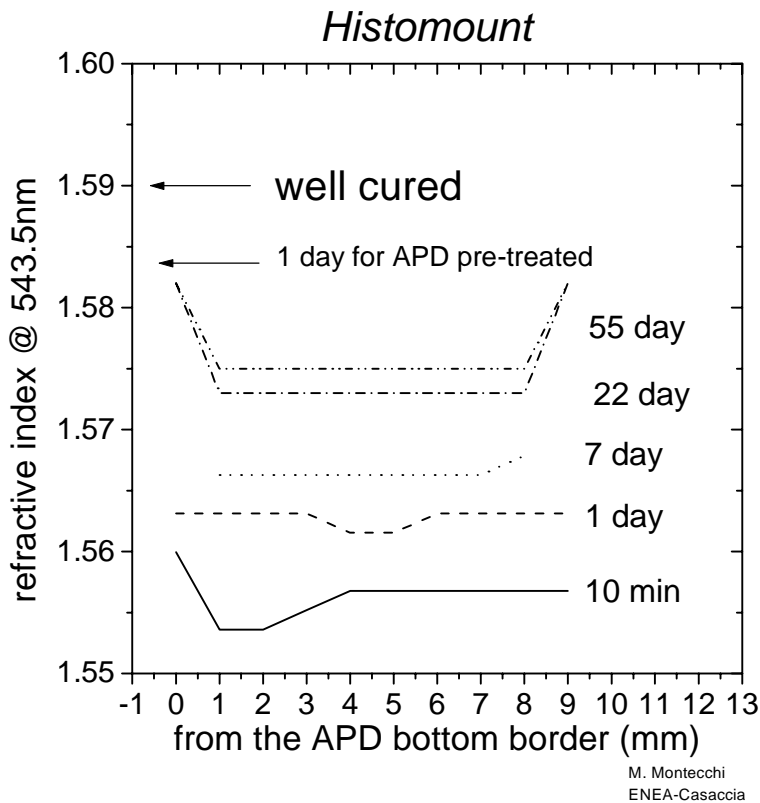
M. Montecchi

Gluing task force

June 30, 1999

PWO(prism)//*Histomount*//APD#404

a)



b) **Critical angle:**

Due to the *epoxy* window, the cut-off angle of the APD readout occurs at

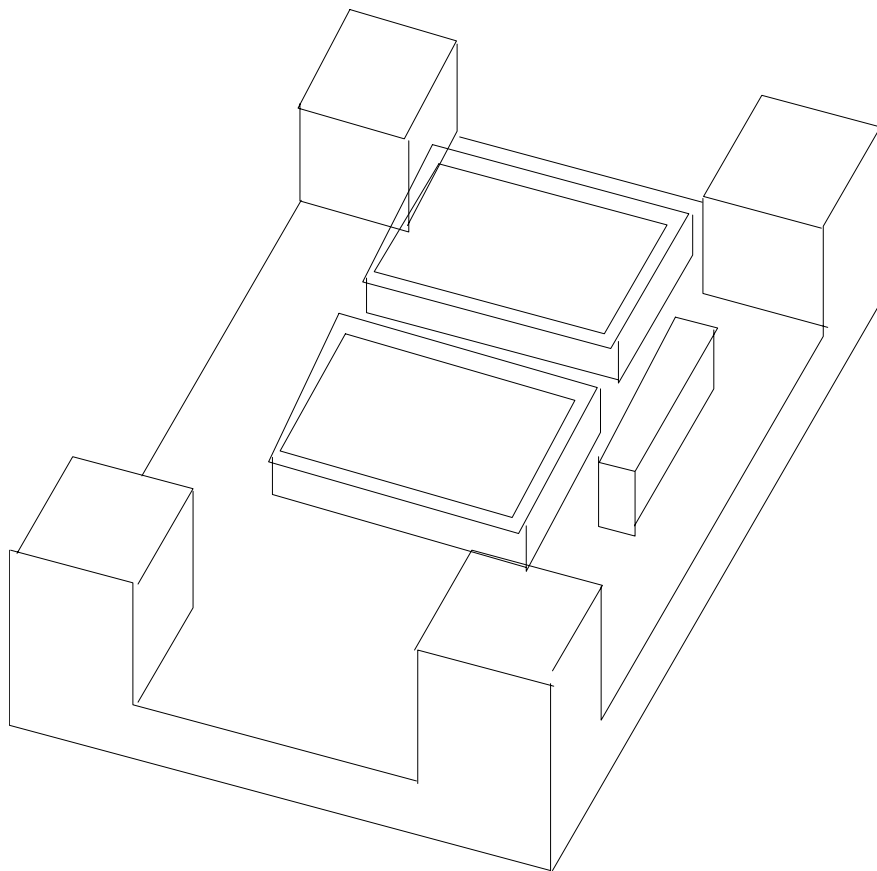
$$\theta_C = 42.4 \text{ deg}$$

$$\Rightarrow n_{\text{EPOXY}} = 1.54 \text{ @ } 543.5 \text{ nm}$$

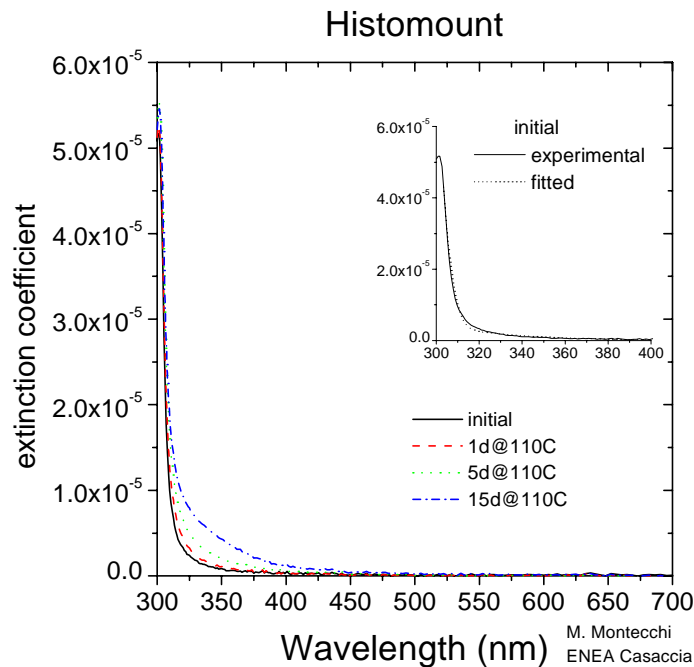
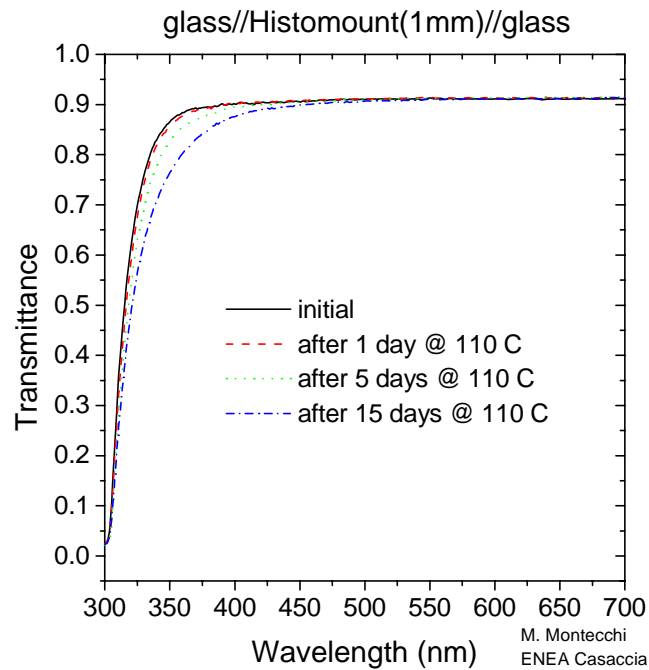
News on *Histomount*

1. Long curing time when sandwiched between PWO and no pre-treated new APD (*Epoxy* window) because of the *bottle effect*
2. When the APD is pre-treated, almost well cured after 1 day, but it is not able to ensure the mechanical adhesion of PWO//capsule ⇒
 - a) **new capsule design**
 - b) **longer wait**
 - c) **+ glue for mechanical adhesion**
3. Does not kill or modify new APDs (along 2 months)
4. **Xylenes** does not affect **capton** and **wrapping** (foil) (1 month in saturated steam)
5. *Histomount* is low degraded after 15 years @ RT

The capsule design should be modified to improve the ventilation; as an example:



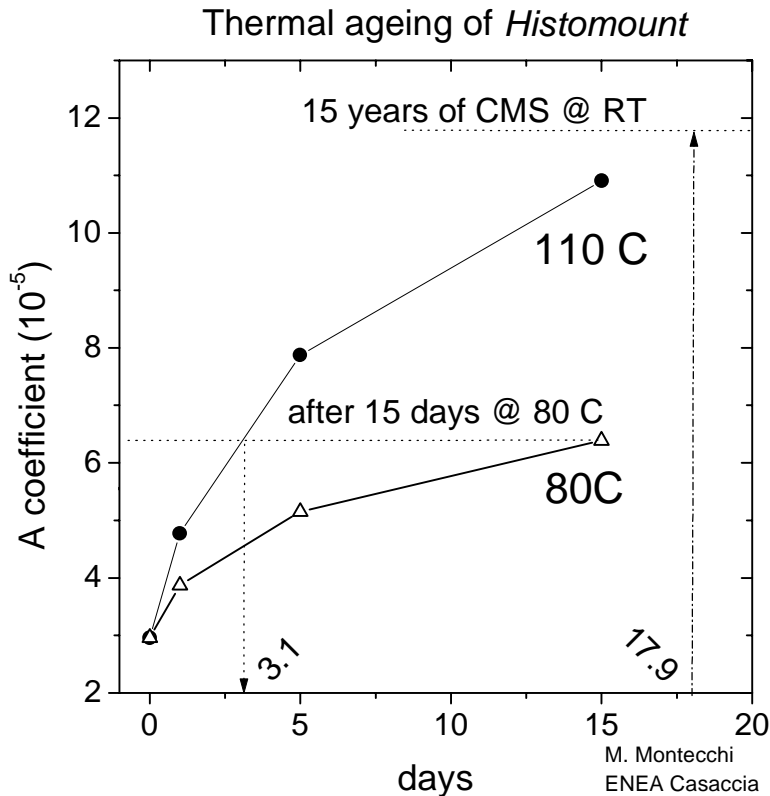
Thermal ageing of *Histomount*



$$k(\lambda) = 17.6e-5 * \exp \left\{ -(\lambda-290)^2 / 11^2 \right\} +$$

$$A * \exp \left\{ -(\lambda-138)^2 / 115^2 \right\}$$

... thermal ageing of *Histomount*



15 days @ 80 C \equiv 3.1 days @ 110 C

assuming the Arrhenius law $\Delta t = C \exp(E_a/kT)$:

- **$E_a/k = 7120 \text{ }^\circ\text{K}$**
- **$(\text{ageing @ 110 C}) / (\text{ageing @ RT}) = 302$**
- **15 years @ RT \equiv 17.9 days @ 110 C**
- **after 15 years @ RT**

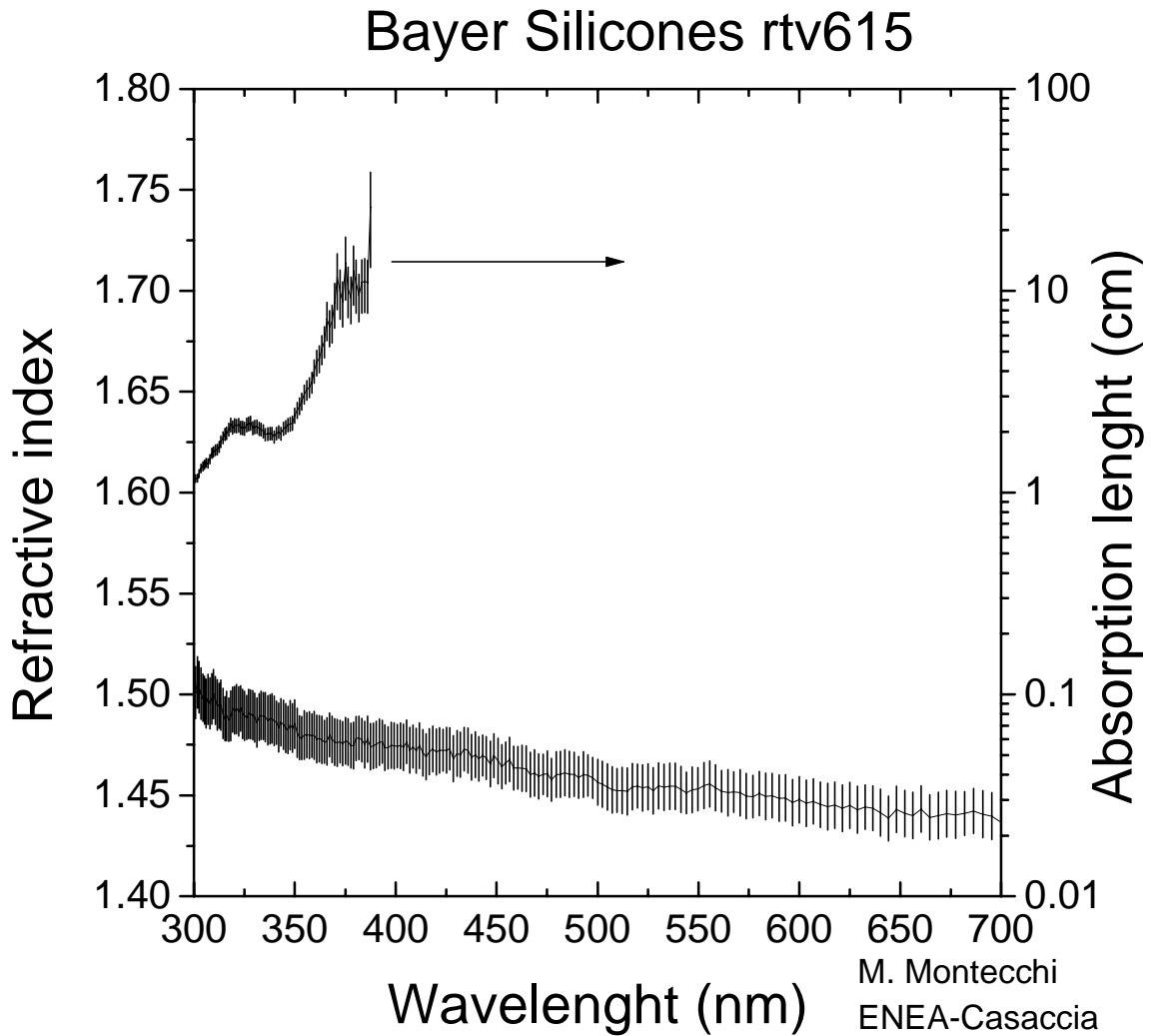
$$A \sim 11.8 \cdot 10^{-5}$$

$$\langle \Lambda \rangle : 13 \pm 4 \rightarrow 3.2 \pm 0.4 \text{ cm}$$

Some glues recently investigated

Glue	$n@430\text{nm}$ ± 0.01	$\langle\Lambda\rangle$ (cm)	comments
Bayer Silicones rtv 615	1.47	> 15 cm	low n
Epotek UV114	1.60	0.40 ± 0.01	<i>NOA61</i> is superior
Epotek 301	1.57	2.7 ± 0.3	Pot life: 1 h Curing: 1day@RT
Epotek 301-2	1.60	> 15 cm	Pot life: 8 h Curing: 2days@RT
Epotek 302	1.62	0.38 ± 0.01	abs. band

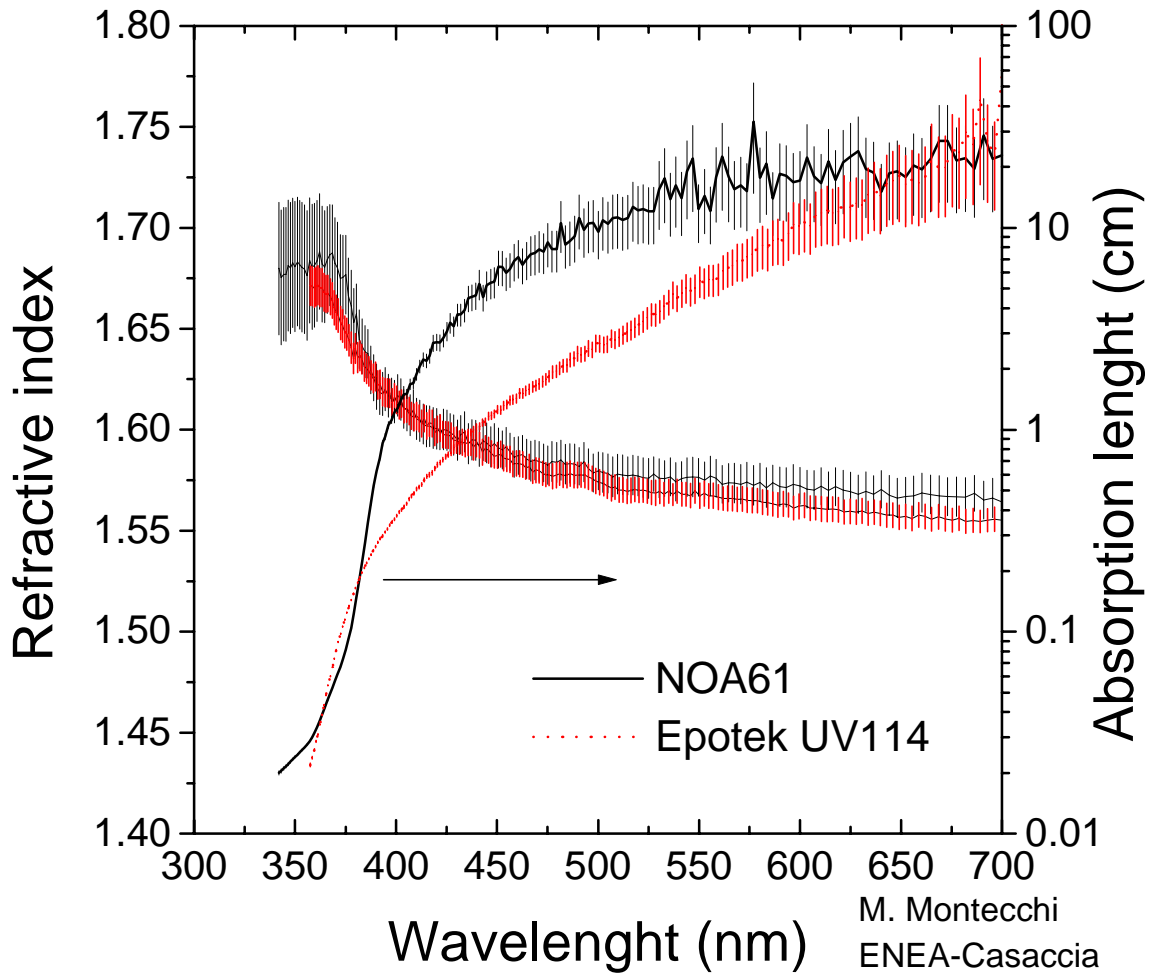
Bayer Silicones RTV 615



low absorption, but low n

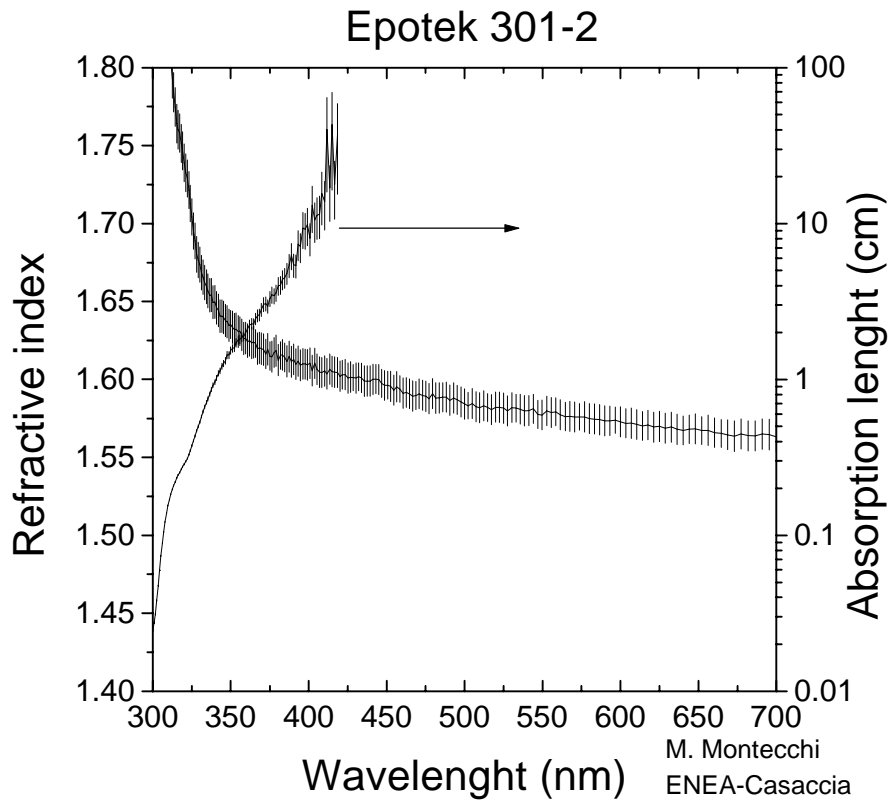
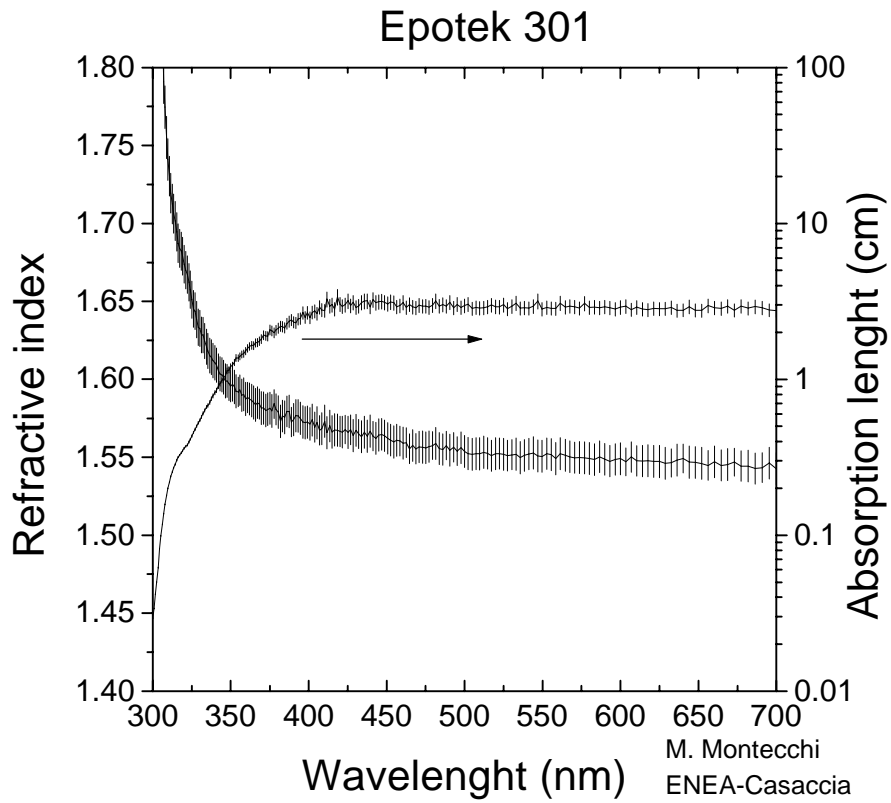
1.47 (1.57 for *Epoxy*) @430 nm

Epotek UV114

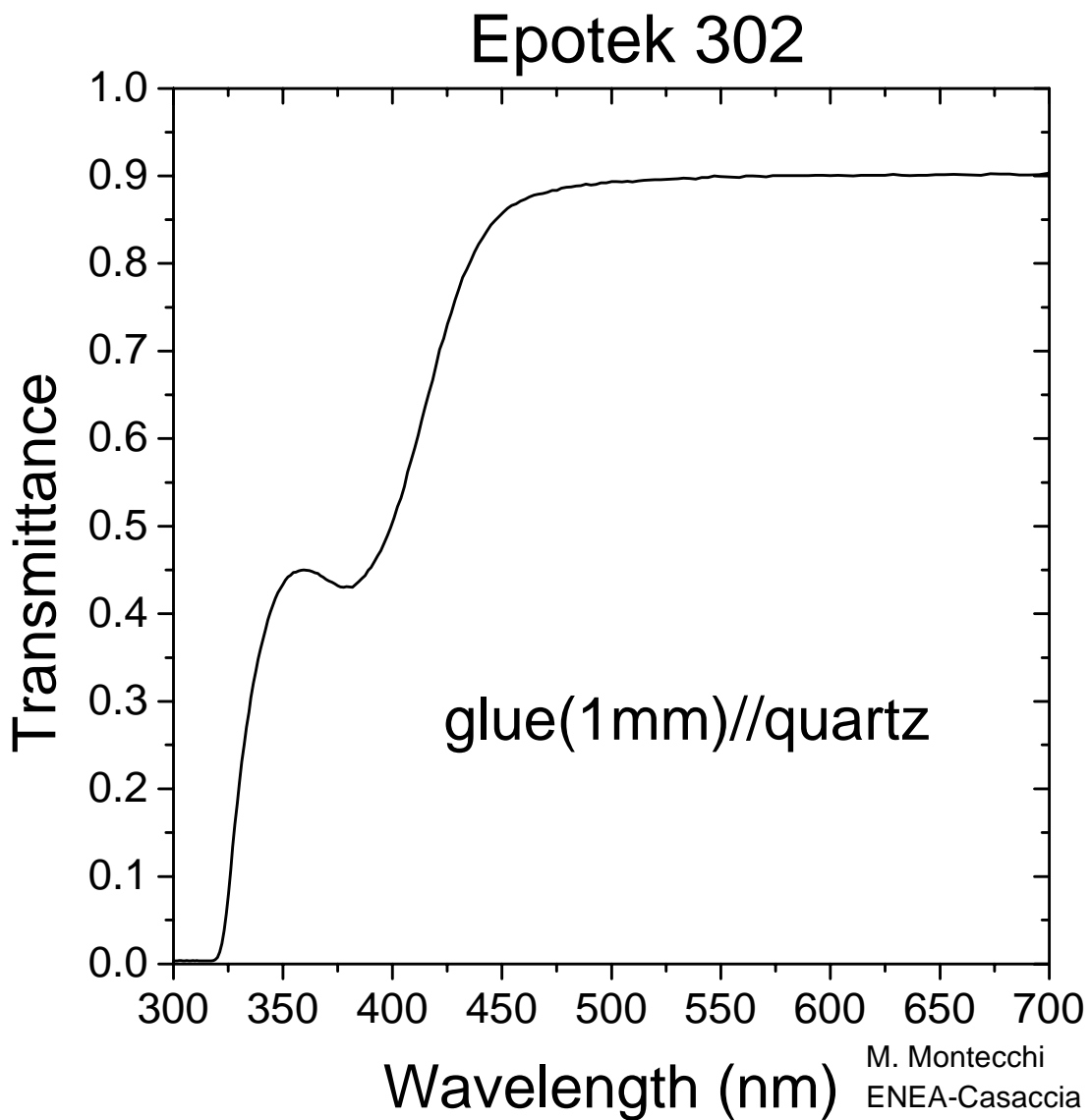


in comparison with the previously investigated UV curing glue, *NOA61*, the refractive index is similar, but the absorption is larger

Epotek 301 and 301-2



Epotek 302



absorption band peaked at 379 nm
reducing the transmittance till 450 nm

Considered glues for CMS (June '99)

glue	manu- facturer	curing	n 430 nm ± 0.01	$\langle \Lambda \rangle$ (cm) (1)	D/E (%) (2)	aging	on bare APD	used in
Histomount (one part)	National Diagnostic	12 h @ RT solvent	1.63	13 \pm 4	11.9	γ OK n OK p OK T OK	OK (5)	Monit. '99 (3)
NOA 61 (one part)	Norland Optical Adhesive	UV curing 5mW/cm ² (350- 380nm) 10 min	1.59	0.40 ± 0.01	11.2	γ OK n OK p OK T OK		
Melmount 1.6 (one part)	Cargille	Thermo- plastic Liquid @ 70°C	1.59	9 \pm 3	11.4	γ OK n OK p OK T~OK	OK	(3)
Epotek 301-2 (two part)	Epoxy Techno- logy inc.	RTV 2 d @RT	1.60	> 15	11.5			
Epoxy (two part)	Shin Etsu	? @ 150°C nitrogen	1.57	11 \pm 6	11.0	γ OK n OK p OK T OK	OK	Hama. PIN & APD (4)
rtv 615 (two part)	GE Bayer Silicones	RTV 6-7d @ RT	1.47	> 15	9.4			Monit. '98

Notes:

- 1) $\langle \Lambda \rangle$ is the glue absorption length averaged on the PWO scintillation spectrum.
- 2) Calculated for the simplified system PWO//glue(0.3mm)//Si₃N₄(65nm)//Si where PWO and Si are semi infinite media and the interposed materials infinitely extended; the reported value is the average on the PWO scintillation spectrum, the incidence angle and the polarisation.
- 3) Melmount and Histomount were sent to Hamamatsu to be used as material for the protective window in Sept. '98.
- 4) Used in new APDs and in some calibrated Hamamatsu PIN. Along several months Yuri Musienko observed the degradation of the quantum efficiency in the 350-500nm range of a new PIN protected with 0.2 mm epoxy layer. Is epoxy not able to prevent the Si degradation
- 5) Since April 13 1999, a bare APD glued with *Histomount* to a glass plate is working and its properties are unchanged