News on glues at June ‘99

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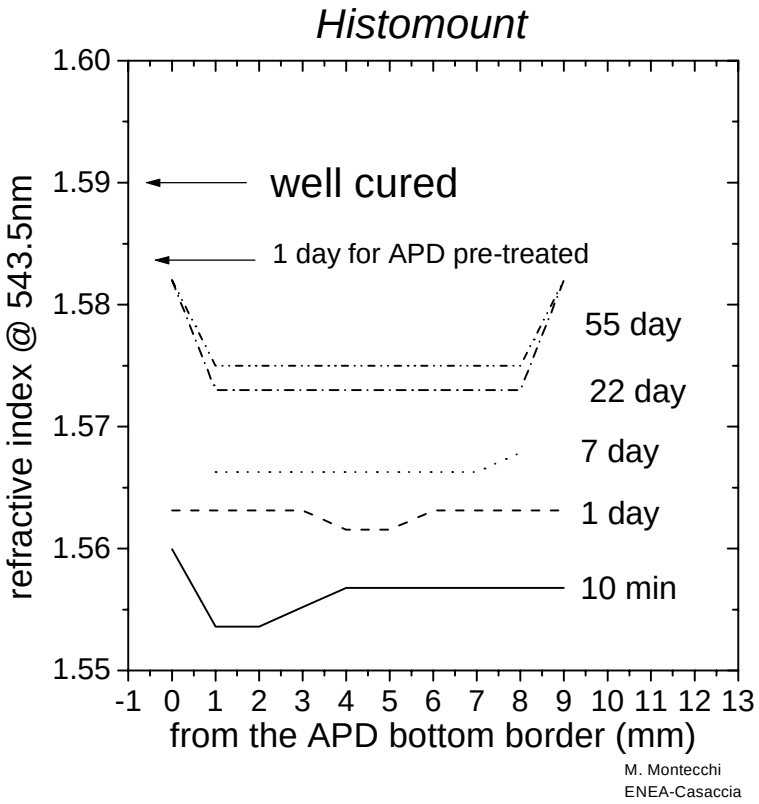
Gluing task force

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

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

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

News on *Histomount*

1. Long curing time when sandwiched between PWO and no pre-treated new APD (*Epoxy* window) because of the ***bottle effect***

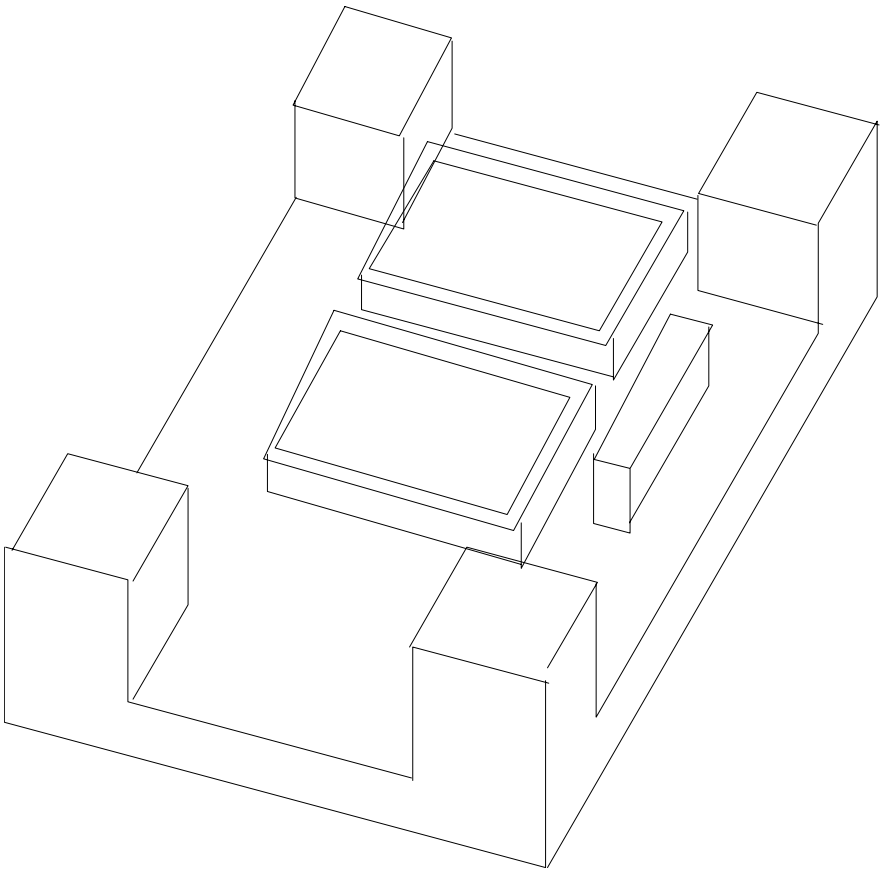
2. When the APD is pre-treated, almost well cured after 1 day, but it is not able to ensure the mechanical adhesion of PWO//capsule ⇒
   a) new capsule design
   b) longer wait
   c) + glue for mechanical adhesion

3. Does not kill or modify new APDs (along 2 months)

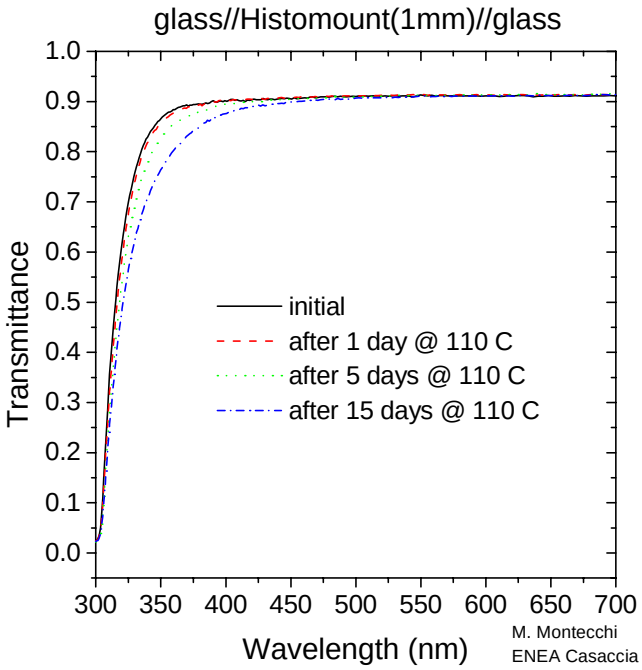
4. **Xylenes** does not affect **capton** and **wrapping** (foil) (1 month in saturated steam)

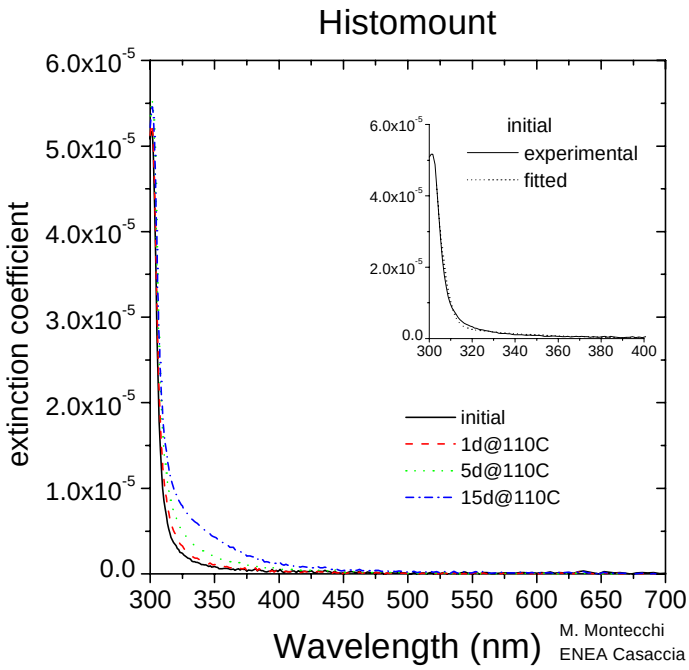
5. *Histomount* is low degraded after 15 years @ RT

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



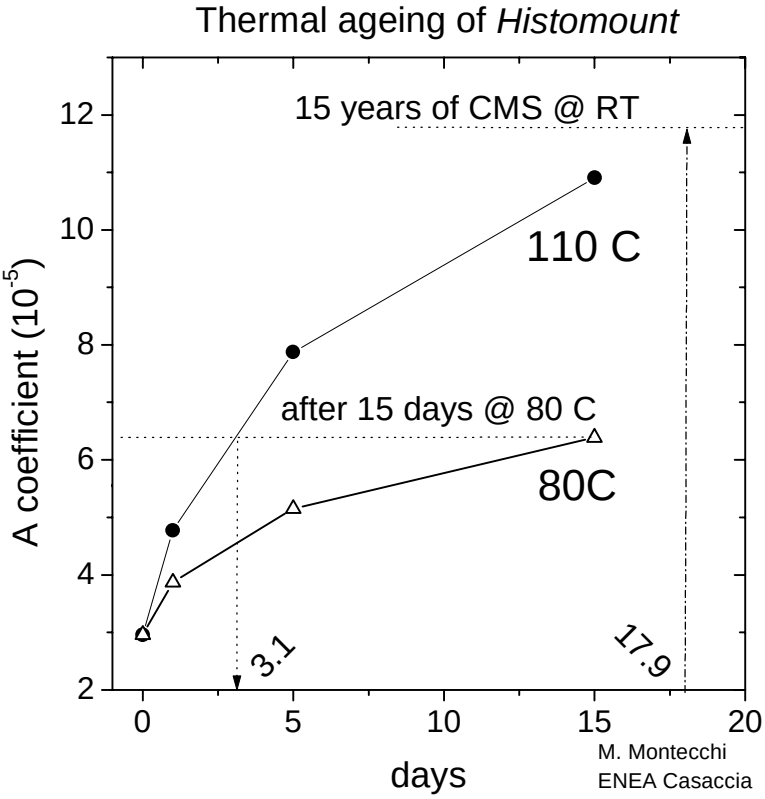
Thermal ageing of *Histomount*





$$k(\lambda) = 17.6e\text{-}5*\exp\{-(\lambda-290)^2/11^2\} + A*\exp\{-(\lambda-138)^2/115^2\}$$

... thermal ageing of *Histomount*



15 days @ 80 C ≡ 3.1 days @ 110 C

assuming the Arrhenius low $\Delta t = C\exp(Ea/kT)$:

- **Ea/k = 7120 °K**
- **(ageing @ 110 C)/(ageing @ RT) = 302**
- **15 years @ RT ≡ 17.9 days @ 110 C**
- **after 15 years @ RT**

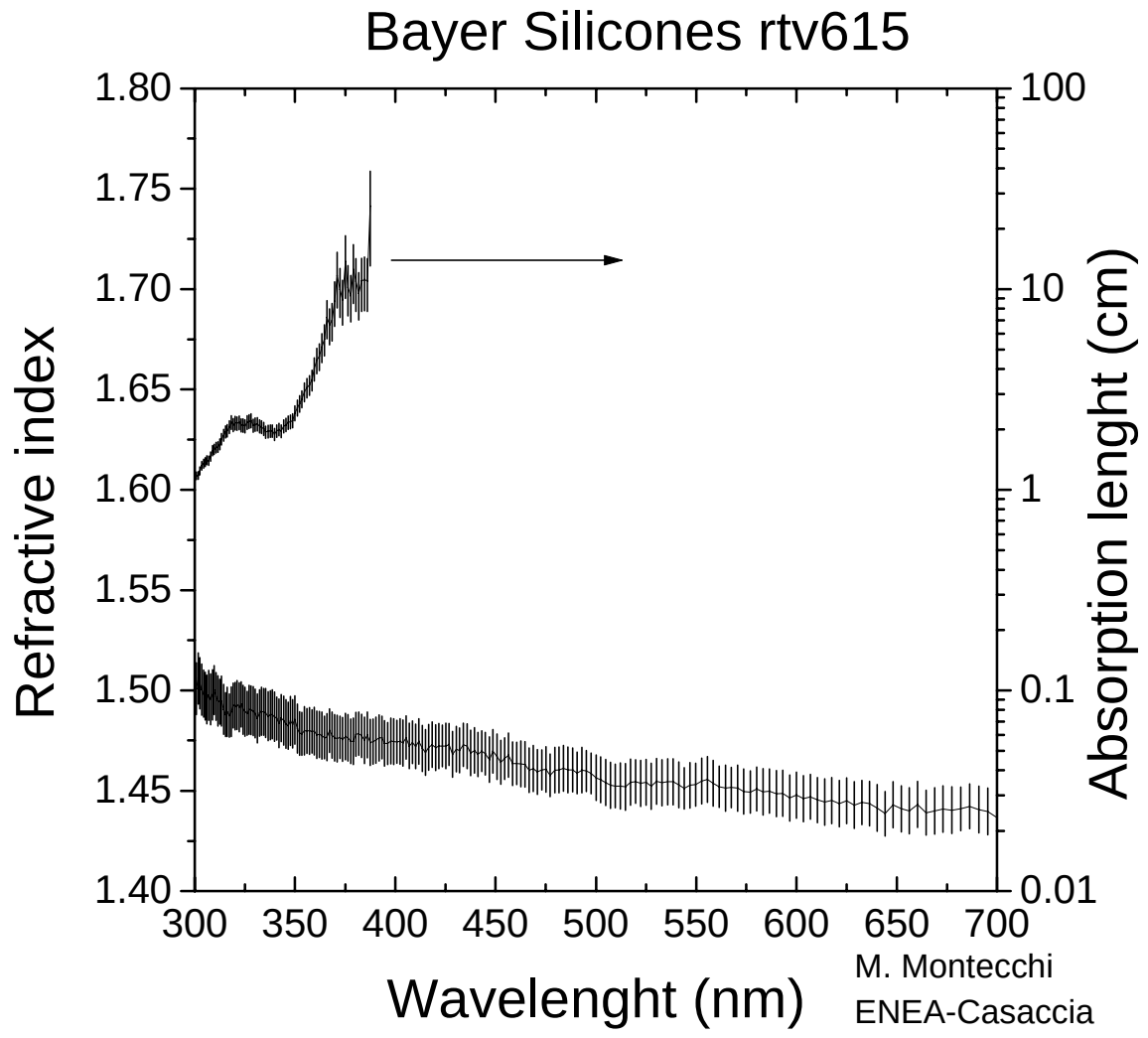
$$A \sim 11.8\ 10^{-5}$$

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

Some glues recently investigated

Glue	*n*@430nm ± 0.01	<Λ> (cm)	comments
Bayer Silicones rtv 615	1.47	> 15 cm	low *n*
Epotek UV114	1.60	0.40±0.01	*NOA61* 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

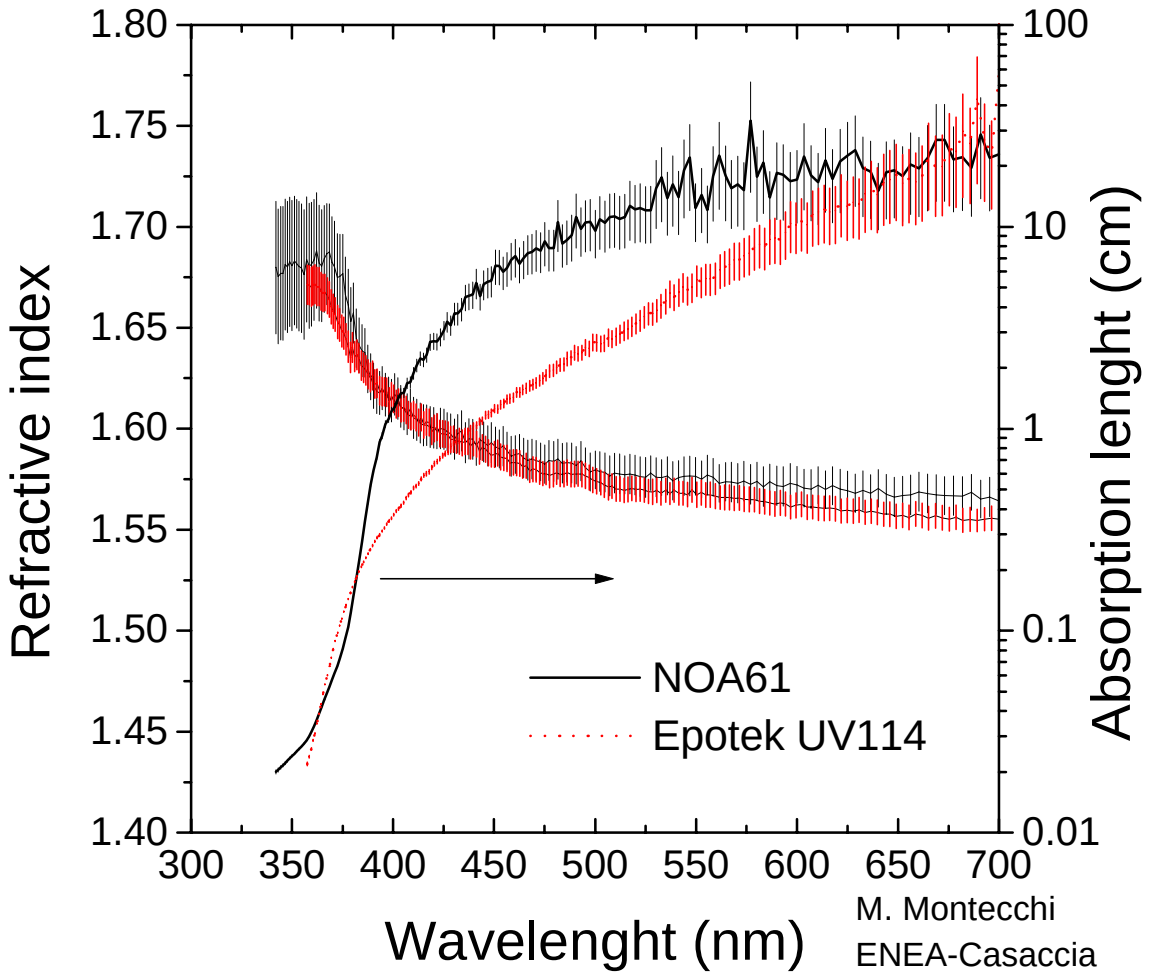
Bayer Silicones RTV 615



low absorption, but low *n*

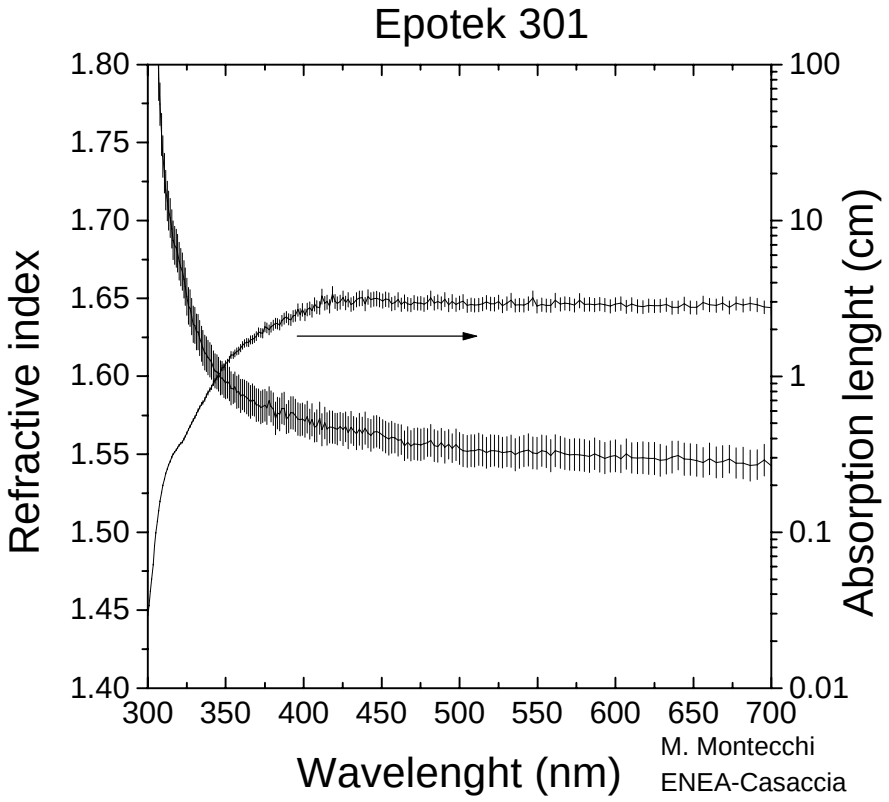
1.47 (1.57 for *Epoxy*) @430 nm

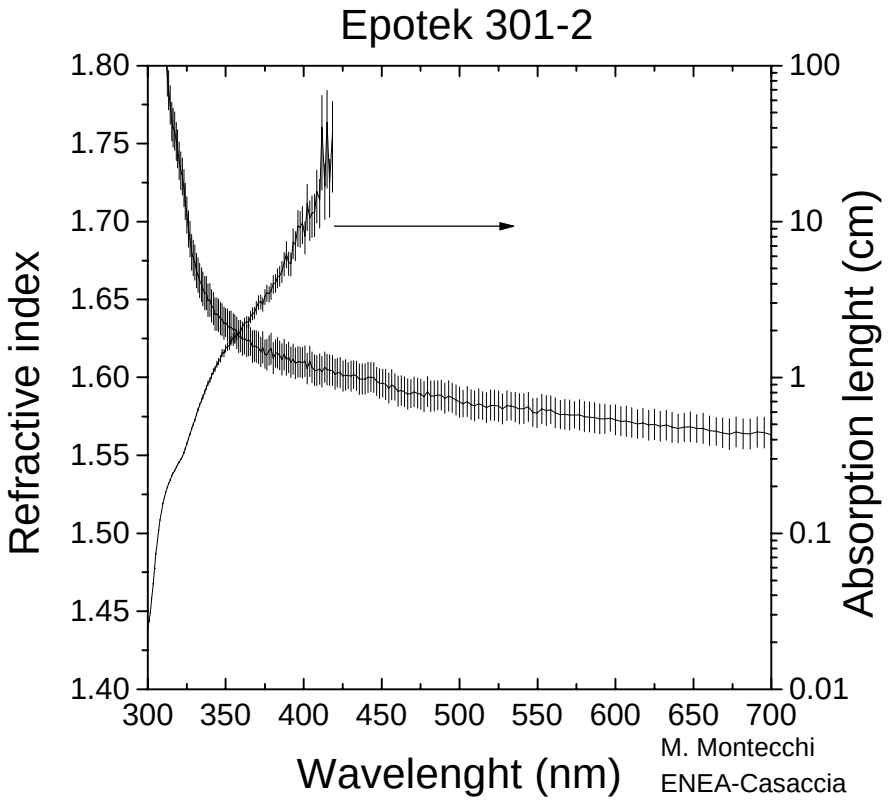
Epotek UV114



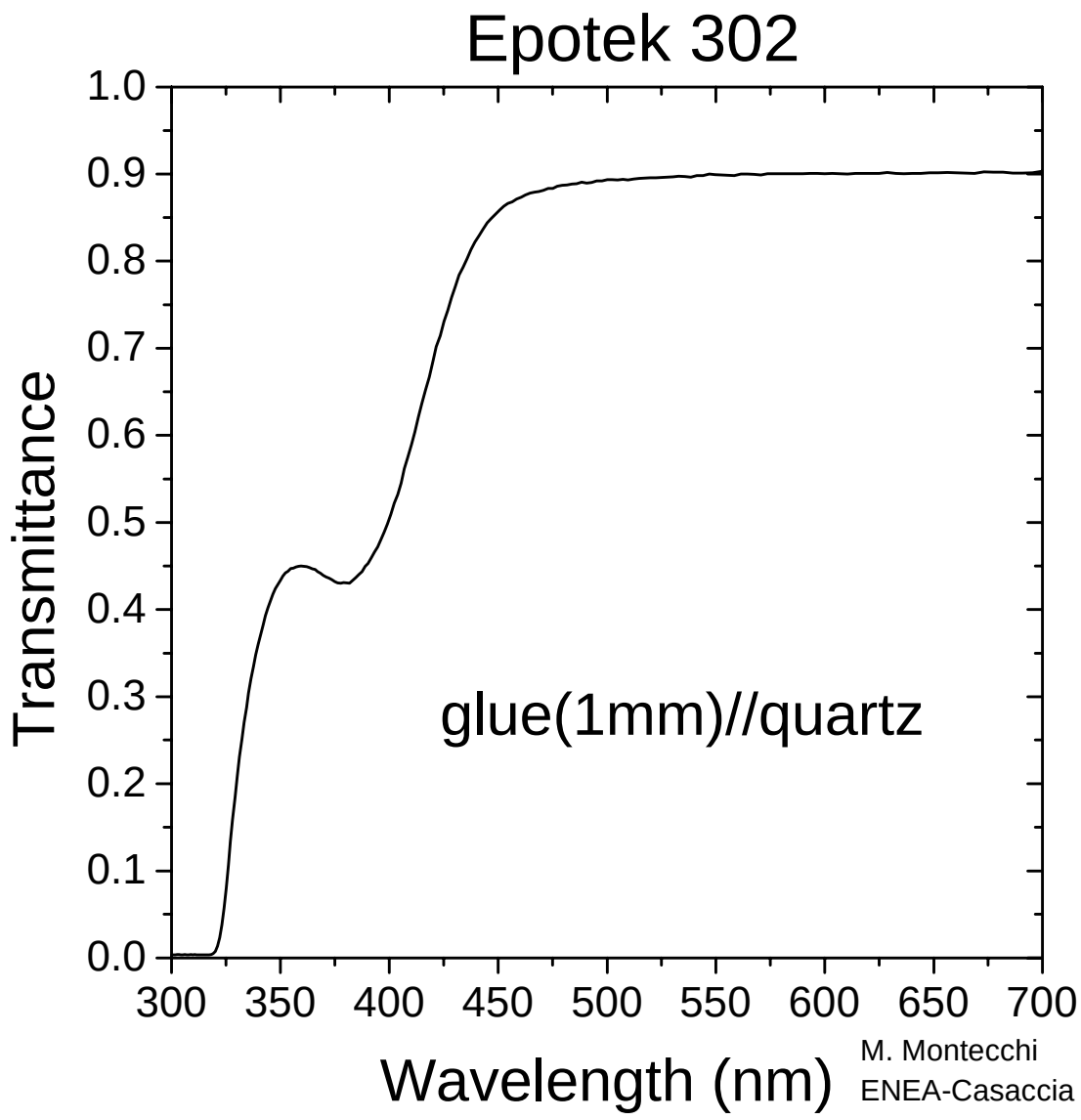
in comparison with the previously investigated UV curing glue, *NOA61*, the refractive index is similar, but the absorption is larger

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	<Λ> (cm) (1)	D/E (%) (2)	aging	on bare APD	used in
Histomount (one part)	National Diagnostic	12 h @ RT solvent	**1.63**	13±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 ± 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± 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) <Λ> is the glue absorption length averaged on the PWO scintillation spectrum.
2) Calculated for the simplified system PWO//glue(0.3mm)//Si_3N_4(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