

Hydric behaviour of silica for VIP and ageing

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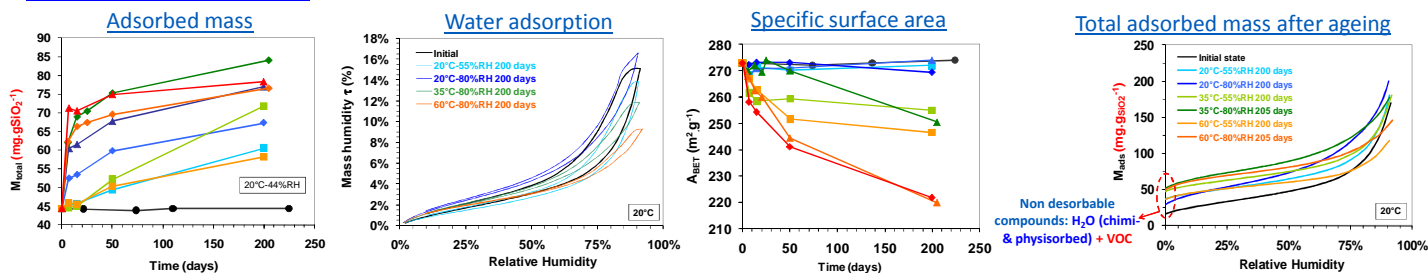
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VIPs age due to the permeation through the envelope and to its degradation.
But what about the silica core material ?

Study 1 : Pure fumed silica powder ageing in climatic chambers

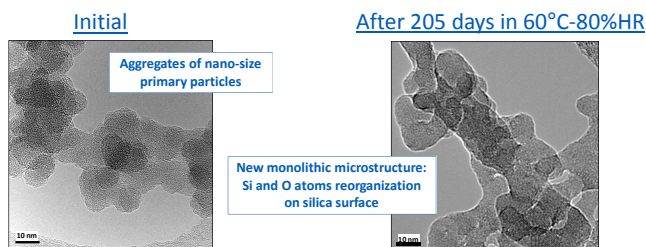
Silica powder : HDK T30®	20°C 44%RH (reference condition)	20°C 55%RH	20°C 80%RH	35°C 55%RH	35°C 80%RH	60°C 55%RH	60°C 80%RH	60°C 95%RH
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Macroscopic observations



Feed back : results gained by ageing in climatic chambers can be affected by hydrophobic VOC (silicone and/or aliphatic)

Microscopic observations: microstructure TEM examination



Conclusions

Evolution of vapor sorption capacity due to :

- surface chemistry modification (hydroxylation)
- microstructure evolution

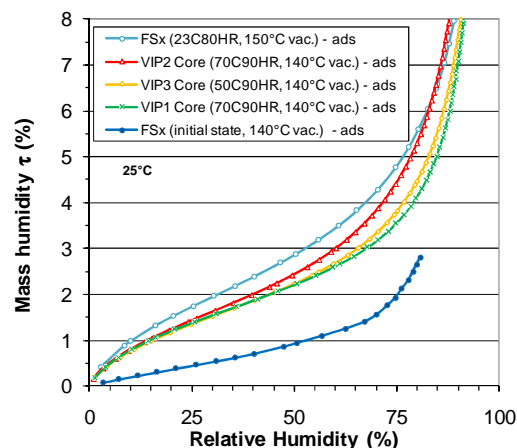
Study 2 : Commercial VIPs ageing

Material	Treatment	VIP mass variation	$A_{\text{BET}} \text{ (m}^2\text{/g)}$	$\tau \text{ (25°C-50%RH)}$
FS _x *	Initial state	-	200	0.94%
FS _x *	23°C-80%RH 30 days	-	170	2.89%
VIP-2 Core**	70°C-90%RH 400 days	+5.3%	155	2.41%
VIP-3 Core**	50°C-90%RH 540 days	+5.0%	142	2.23%
VIP-1 Core**	70°C-90%RH 540 days	+5.0%	134	2.24%

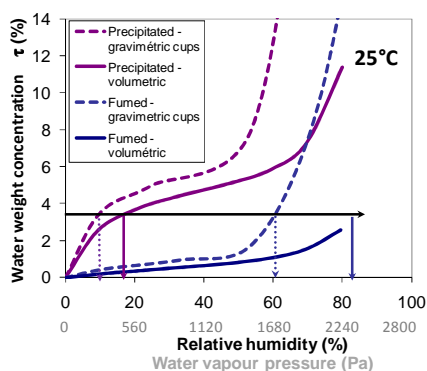
*Commercial fumed silica noted as « FS_x », **core material based on fumed silica FS_x

Conclusion

Modification of silica surface chemistry and microstructure in VIPs despite any damage to their envelope



Consequences for life prediction



On core material characterization:

Most of the published data (as in Annex 39) are not those of new silica but of silica aged during the characterization

On the prediction of the pressure inside VIPs:

Real behaviour after the given ageing has to be considered