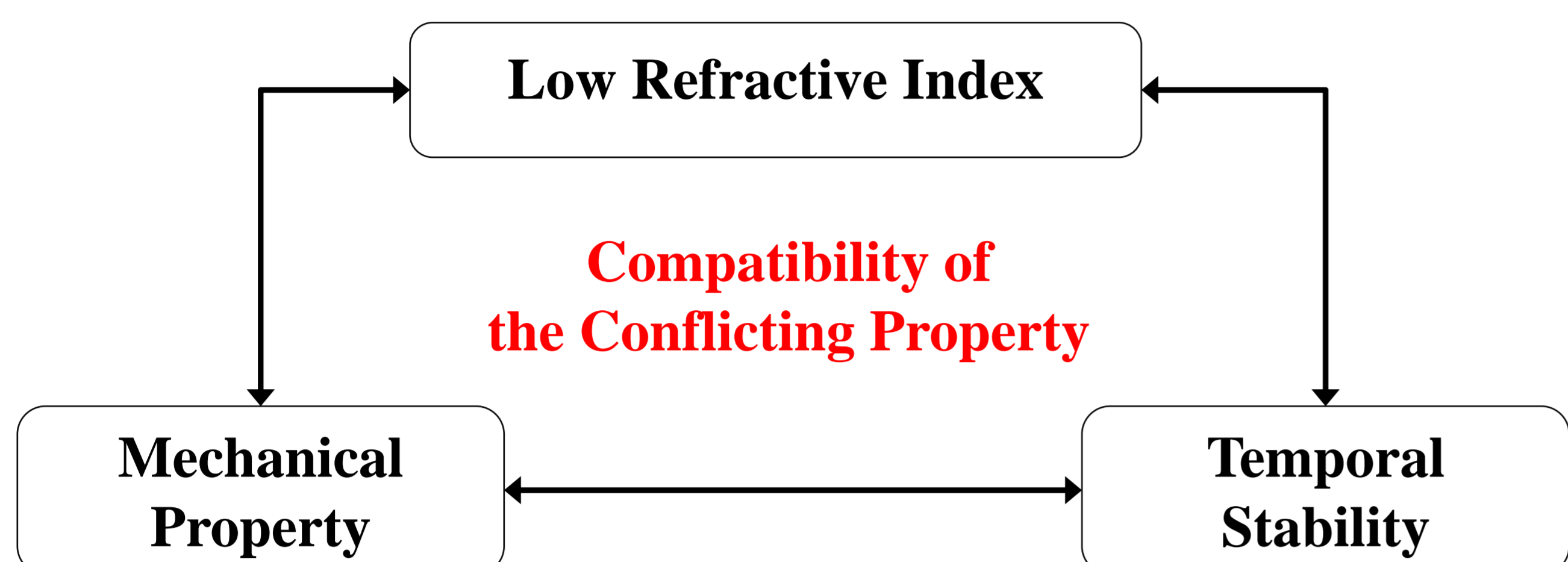


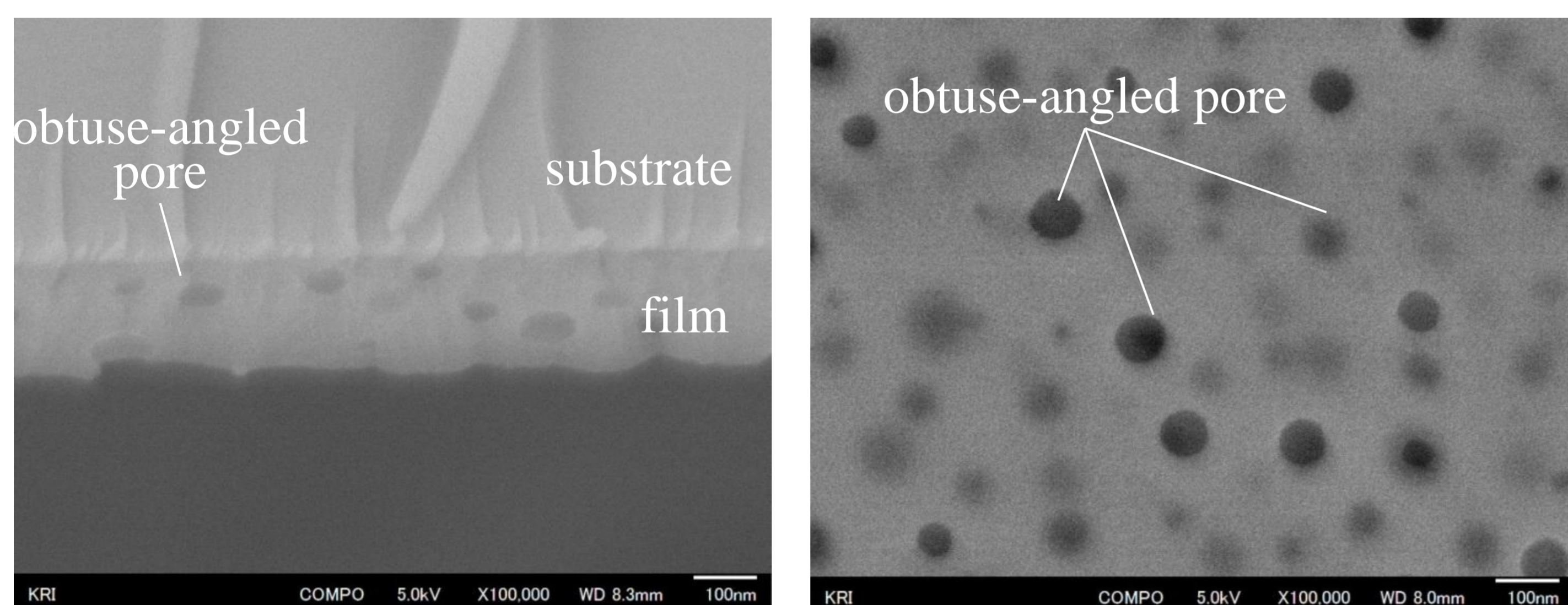
KRI has succeeded to make the films by using the fluorinated silicate derivatives loading the low environment.

The films are hard, low refractive, and stable formation. The conflictive features are maintained in the films.

1. Background

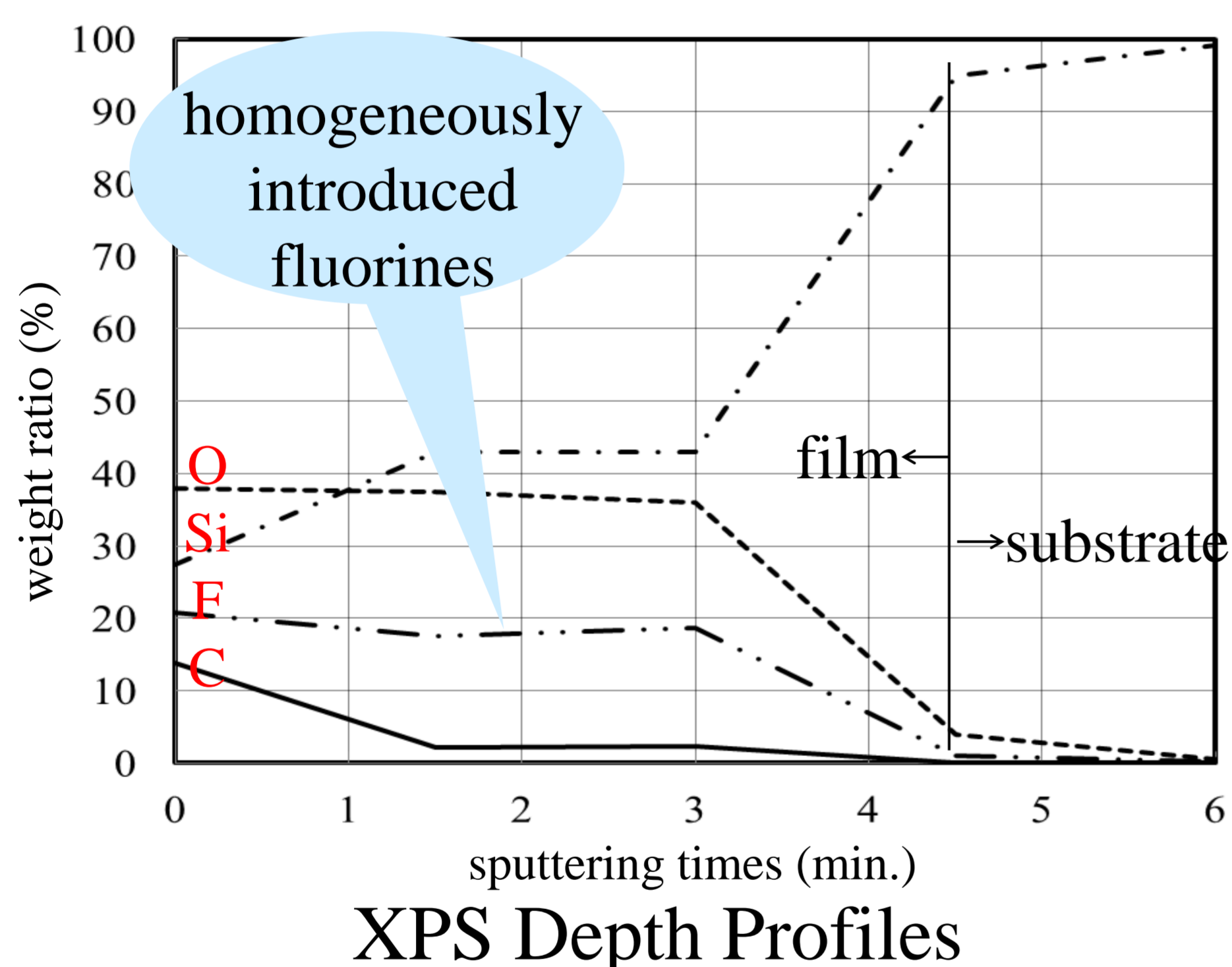


3. Results



SEM (cross-section)

SEM (surface)

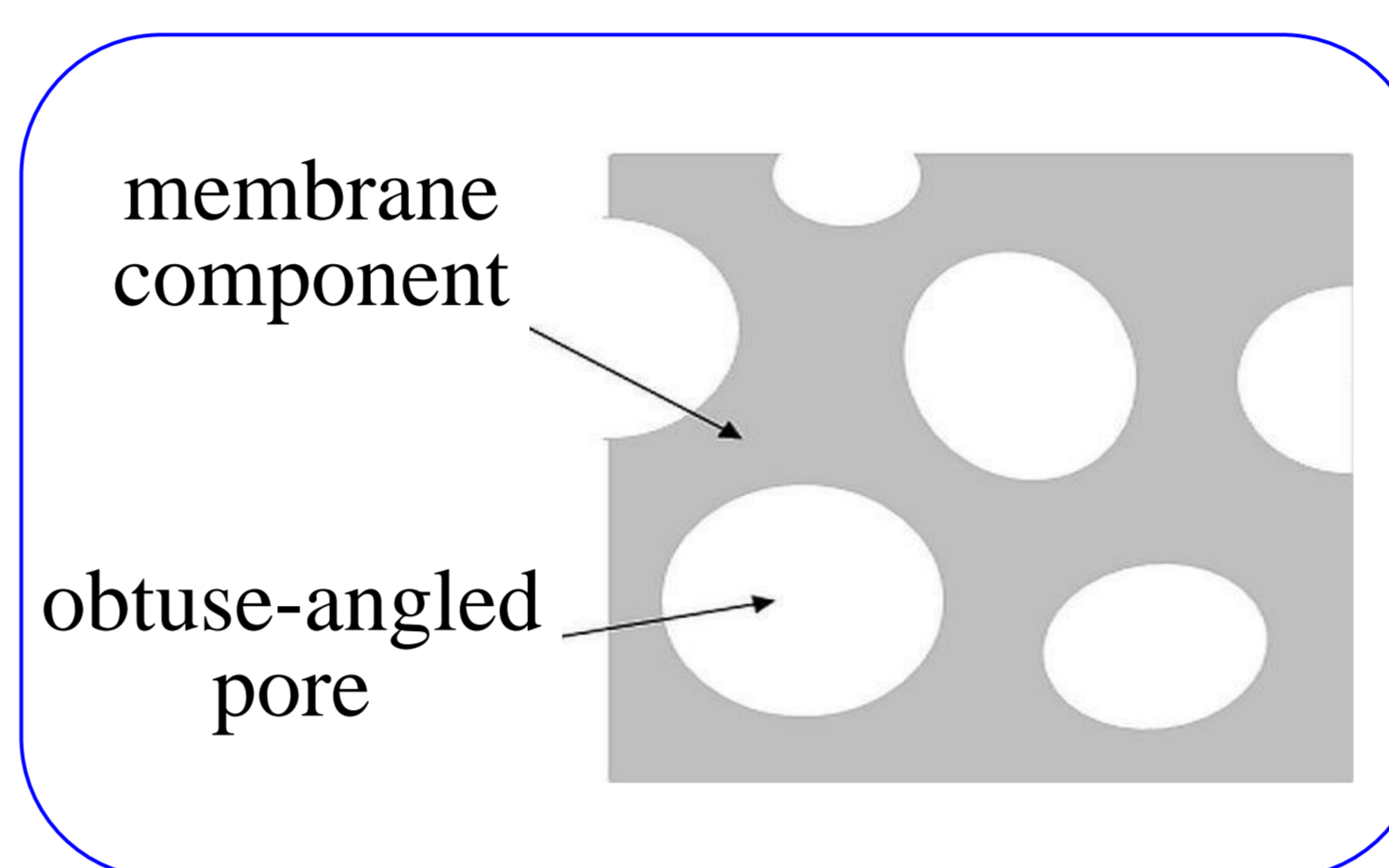


4. Conclusion

- The porous films with the obtuse-angled pores with less than 150nm in a diameter are formed using the silicate precursor with fluorine-contained alkyl groups.
- The resultant films have the properties such as followings;
 - (1) Low refractive index (1.38) and 3H hardness,
 - (2) Homogeneous introduction of the fluorine elements,
 - (3) Water and oil repellency and very small slip angle (e.g. 7deg. to oil).
- It is revealed incorporation of the obtuse-angled pores are attractive for increasing porous film strength.

2. Concepts

- To keep strength of a porous film, it is necessary to make the obtuse-angled pores on the inside. Fractural strength (σ_A) of a porous film is described by the following equation.



$$\sigma_A = 2\sigma \sqrt{\frac{x}{\rho}}$$

x : semimajor axis
 ρ : curvature radius *(figure)
 ($\rho = y^2/x$, y : semiminor axis)

- To prepare a porous film with the obtuse-angled pores, the silicate precursor with fluorine-contained alkyl groups is investigated.

Property comparison

	this study	target	comparable data	
			PFA*1	silicone
surface energy (mN/m)*2	4.6		17.8	27
contact angle (deg.)	water 98		105-110	98
	n-hexadecane 53		>45	38
falling angle (deg.)	water 36		-	14
	n-hexadecane 7		-	-
refractive index (spectroreflectometry, Si, n _D)	1.38	1.3	1.375	1.4
pencil hardness*3	3H		2H	-

*1 fluorine resin : Teflon and Engineering Resin Property List
 *2 calculated by Zisman plot
 *3 on the glass substrates

PAT.PEND.

5. Proposal from KRI

KRI will propose the following application using the present special technique.

- Development of the hard and low refractive index films for the AR film
- Development of surface treatment agents and of films with water and oil repellency
- Development of the surface treatment films superior in low friction and wear resistance