

Table 2.2 Material properties for Parylene N, C and D [reprinted with permission from J.

B. Fortin and T. M. Lu, *Chemical vapor deposition polymerization*, © 2004 Springer].

Property	Parylene N	Parylene C	Parylene D	
Electrical property				
Dielectric Constant	1 MHz	2.65	2.95	2.8
	1 KHz	2.65	3.10	--
	60 Hz	2.65	3.15	--
Dissipation factor	1 MHz	0.0006	0.013	0.002
	1 KHz	0.0002	0.019	--
	60 Hz	0.0002	0.020	--
Dielectric strength (MV/cm)	300	185-220	215	
Volume resistivity (23°C, 50% RH)	1.4×10^{17}	8.8×10^{16}	2×10^{16}	
Surface resistivity (23°C, 50% RH)	1×10^{13}	1×10^{14}	5×10^{16}	
Physical Property				
Melting point (°C)	420	290	380	
Glass transition (°C)	13-80	35-80	110	
Linear coefficient of expansion ($25^\circ\text{C} \times 10^{-5}, \text{K}^{-1}$)	6.9	3.5	--	
Heat capacity (25°C, J/gK)	1.3	3.5	--	
Thermal conductivity (25°C, kW/mK)	1.3	1.0	--	
Density (g/cm ³)	1.110	1.289	1.418	
Refractive index	1.661	1.639	1.669	
Mechanical Property				
Tensile modulus (Gpa)	2.4	3.2	2.8	
Tensile strength (Mpa)	45	70	75	
Yield strength (Mpa)	32	55	60	
Elongation to break (%)	30	200	10	
Yield elongation (%)	2.5	2.9	--	
Static coefficient of friction	0.25	0.29	0.35	
Dynamic coefficient of friction	0.25	0.29	0.31	
Hardness (Gpa)	0.6 (least)	Moderate	--	
Moisture resistant				
Water absorption (%) after 24 hrs	0.1	0.1	0.1	
Coating performance				
Crevice penetration	Best	Good	Least	
Molecular activity	Highest	Good	Least	
Coating uniformity	Best	Good	--	
Thickness control	Good	Best	--	
Coating speed	Lowest	Moderate	Highest	

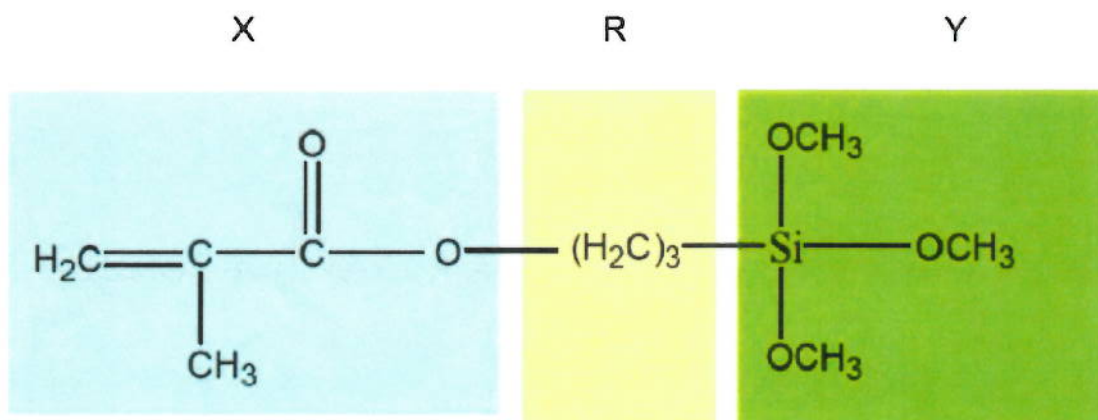


Fig 2.10 The chemical structure of Silquest A-174 ® silane. The functional group X can form covalent bonds with Parylene monomer, and Y (right) can be hydrolyzed and form covalent bonds with substrates.

Table 2.1 Water vapor transmission rate (WVTR) for polymers and atomic layer deposited Al_2O_3 .

Material	WVTR ($\text{g}\cdot\text{mm}/\text{m}^2\cdot\text{day}$)
Epoxy	0.5-1
Polyimide (DuPont)	1.4
Silicone, RTV	46.8
PTFE (DuPont)	0.1
Parylene C (Specialty Coating Systems)	0.4
Parylene N (Specialty Coating Systems)	5.4
Atomic Layer Deposited Alumina	$\sim 10^{-10}$