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จุฬาลงกรณ์มหาวิทยาลัย

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SYNTHESIS OF POLY(N-PHENYLMALEIMIDE-CO-*p*-EPOXYSTYRENE  
-CO-STYRENE)



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ลายมือชื่อนิสิต บัญชา พูลโกคา  
ลายมือชื่ออาจารย์ที่ปรึกษา ศุภวรรณ ตันตยานนท์  
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม —



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SYNTHESIS PHOTORESIST/ POLY (PARA-EPOXYSTYRENE)

BUNCHA POLPOKA : SYNTHESIS OF POLY (N-PHENYLMALEIMIDE-CO-P-EPOXYSTYRENE-CO-STYRENE).

THESIS ADVISOR : ASSOC. PROF. SUPAWAN TANTAYANON, PH.D.,  
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The synthesis of poly (N-phenylmaleimide-co-p-epoxy-styrene-co-styrene) was started with the synthesis of two monomers, N-phenylmaleimide and p-chloromethylstyrene. The reaction of aniline and maleic anhydride afforded maleanilic acid and then was converted to N-phenylmaleimide by acetic anhydride. p-Chloromethylstyrene was obtained from chloromethylation of 2-phenylethyl bromide and subsequent dehydrobromination. Then, copolymerization of p-chloromethylstyrene, styrene and N-phenylmaleimide was carried out. The percentage of N-phenylmaleimide was varied as 0, 5, 10, 25 and 50% by mole. Consequently, the chloromethyl group was converted to carboxaldehyde group and, finally, underwent epoxidation to form the epoxide group. The results showed that the more percentage of N-phenylmaleimide in the copolymers, the higher glass transition temperature ( $T_g$ ) was. All the synthesized compounds were characterized by the spectroscopic technique.



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## ABBREVIATION

AIBN	azobis(isobutyronitrile)
Å	angstrom
C	coulomb
cm <sup>2</sup>	square centimeter
CEL	Contrast enhancement level
CMS	<i>p</i> -chloromethylstyrene
CVD	Coating vapor deposition
EA	ethylacrylate
d	doublet
dd	doublet of doublet
DMSO	dimethylsulfoxide
GA	glycidylacrylate
GC	gas chromatography
GMA	glycidylmethacrylate
GPC	gel permeation chromatography
hrs.	hours
IR	infrared
J	joule
L	liter
min.	minute
ml	millilitre
Mn	number average molecular weight
Mw	weight average molecular weight
MWD	molecular weight distribution
NMR	nuclear magnetic resonance
NPhMI	N-phenylmaleimide



## ABBREVIATION (continued)

PCMS	chloromethylated polystyrene
PDOP	poly(diallylorthophthalate)
PMMA	poly(methyl methacrylate)
ppm	part per million
psi.	pound per square inch
PVA	polyvinyl alcohol
PVK	poly(vinyl-carbazole)
RIE	Reactive ion etching
rpm	round per minute
s	singlet
sec.	second
ST	styrene
t	triplet
%T	% transmittance
$T_g$	glass transition temperature
UV	ultraviolet
$\gamma$	contrast
$\mu\text{m}$	micrometer
$\nu$	wavenumber
$\delta$	chemical shift