

PHOSPHORYLATED EPOXY ADHESIVES

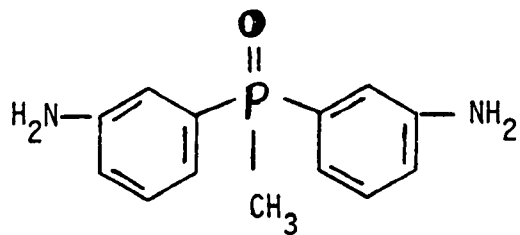
Norman Bilow
Hughes Aircraft Company



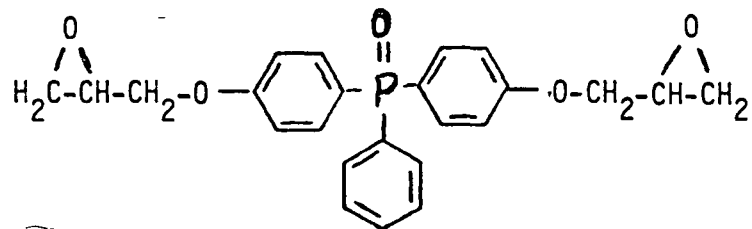
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DEVELOPMENT
OF
FIRE RETARDANT ADHESIVES
FOR
AIRCRAFT INTERIORS

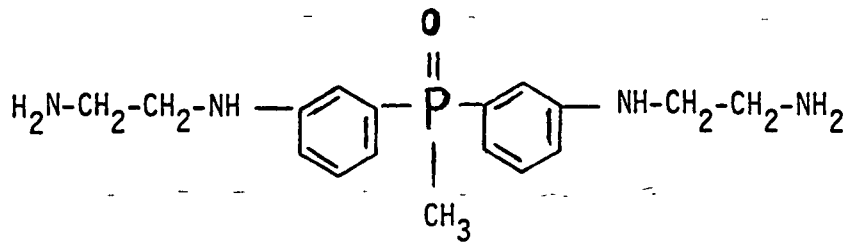
MONOMERS



12.6% P

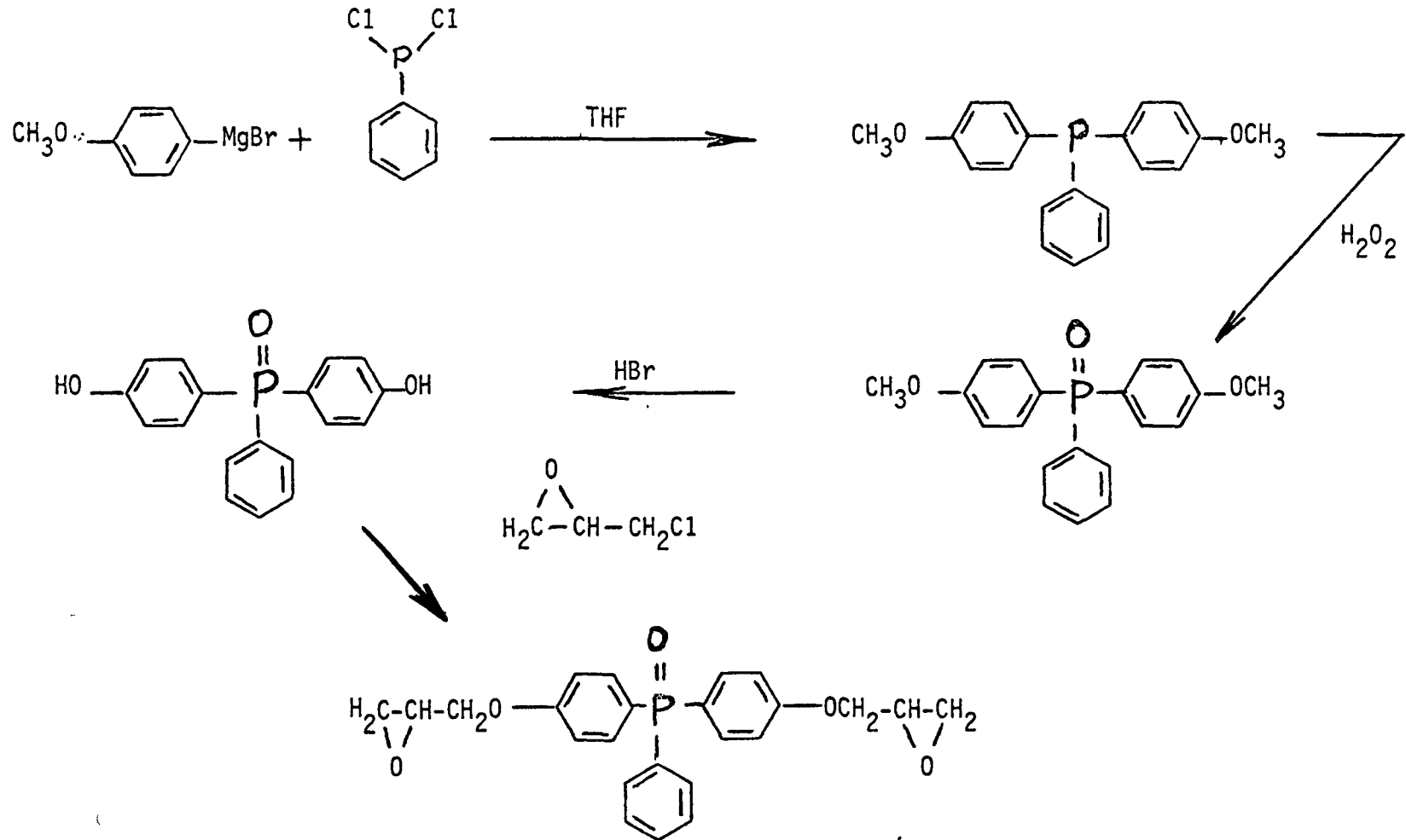


7.35% P



9.3% P

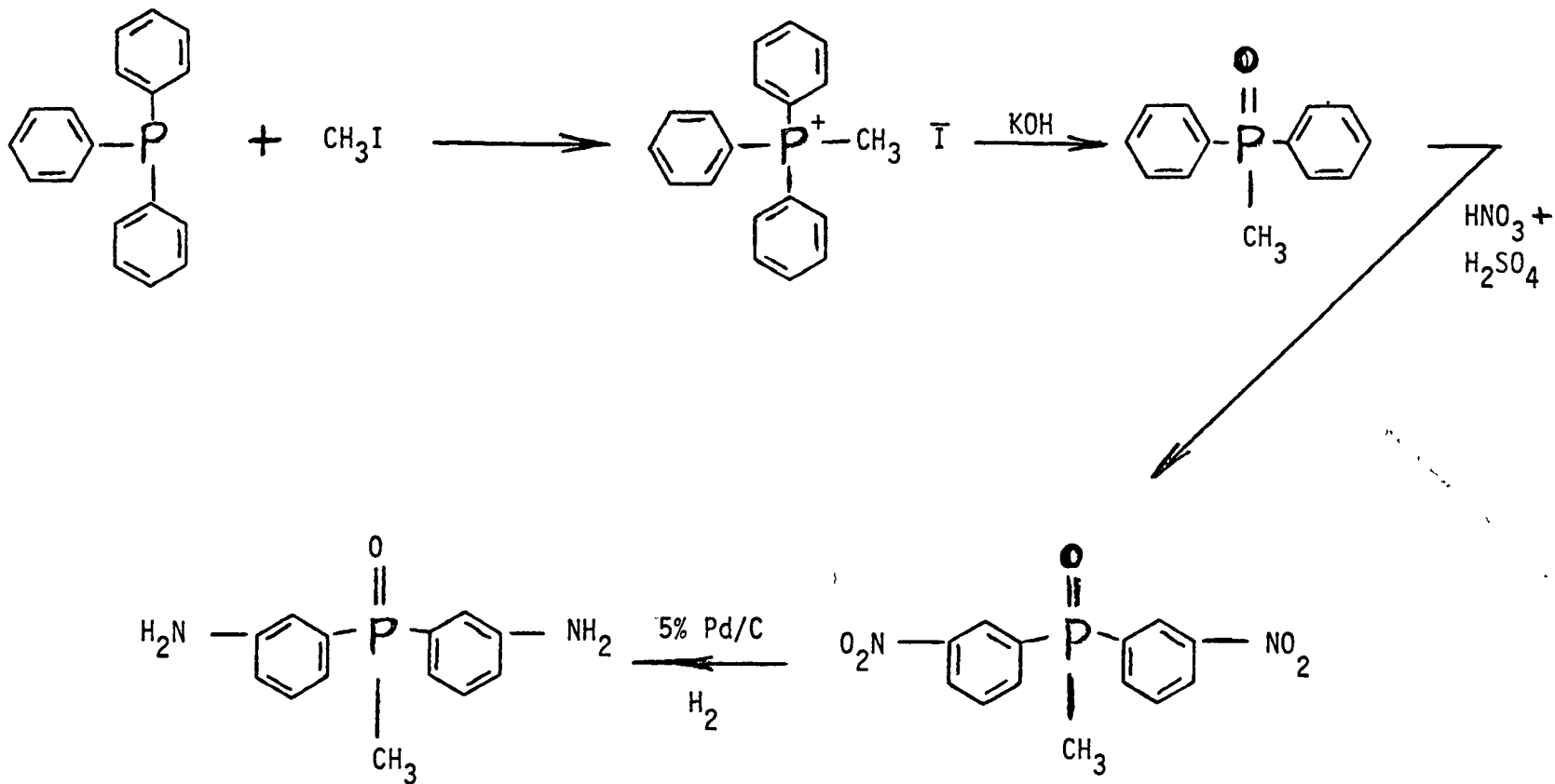
EPOXY SYNTHESIS



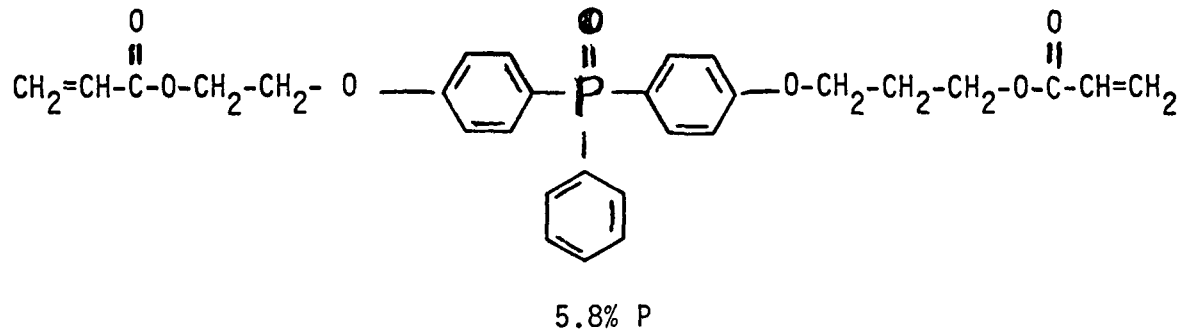
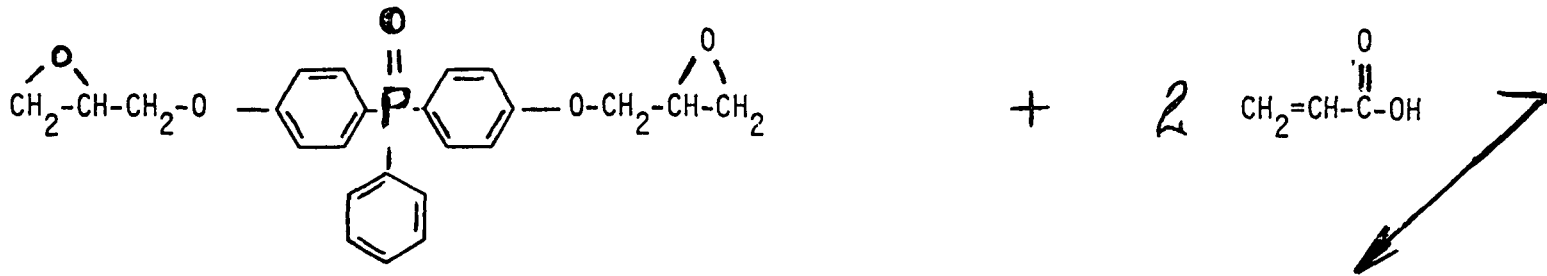
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DIAMINE SYNTHESIS

HUGHES
HUGHES AIRCRAFT COMPANY



ACRYLIC MODIFIED EPOXY



PHOSPHORYLATED AMINE EPOXY BLENDS



PHOSPHORYLATED AMINE MOLES	PHOSPHORYLATED EPOXY	EPON 825	IMPACT STRENGTH FT. LBS.
1	0	1	0.23
1	0.3	0.7	0.19
1	0.4	0.6	0.07
1	0.5	0.5	0.05

ALL BLENDS WERE FIRE RETARDANT.

EPI REZ 5022 FORMULATIONS



% EPI REZ	CURE SCHEDULE		LAP SHEAR STRENGTHS P.S.I.
	HR.	°F.	
26	0.5	450	985
	1.0	450	650
	1.75	450	325
	16	230	1000-1100**
	16	230	1200-1400*
19	1.0	300	1118*
	2.0	300	1589*
	4.0	300	1798*
	0.5	350	1304*
	2.0	350	1102*

** PRIMED SUBSTRATES

* UNPRIMED SUBSTRATES

SUBSTITUTE DIAMINES



N-AMINOETHYLPIPERAZINE

DIETHYLENETRIAMINE

TRIETHYLENETETRAMINE

DIETHYLAMINOPROPYLAMINE

JEFFAMINE, D-400

OTHER EPOXY RESINS*



*PARTIAL SUBSTITUTIONS

PROBLEM

EPON 825

BRITTLINESS

EPON 828

INCOMPATIBILITY

EPI REZ 5022

DIFFICULTLY COMPATIBLE
BLENDED BY MILLING

EPI REZ 505

INCOMPATIBILITY

DER 732

INCOMPATIBILITY

HONEYCOMB STRUCTURE



PHENOLIC/GLASS HONEYCOMB
POLYIMID/GLASS LAMINATE (CLEANED BY HP 9-30)
TEDLAR SODIUM/NAPHTHALENE/THF ETCHED

IN FLATWISE TENSION THE LAMINATE-TO-HONEYCOMB BOND BROKE AT 303 PSI (HONEYCOMB FAILURE)
(ACRYLIC SAMPLE PROVIDED TO HUGHES BY NASA FAILED AT 112 PSI

TEDLAR-TO-LAMINATE

TEDLAR BROKE AT BOND LINE WITHOUT PEELING