NEW DIELECTRICS FROM SOY OIL RESIN AND NATURAL FIBERS

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SYNTHESIS

Phthalic anhydride (PA)  Catalyst  135 °C, 6 hr

AESO

AESO/PA

Alternative: Maleic anhydride

MONOMER AND POLYMER PROPERTIES

Storage modulus/MPa

Different Polymers

PAESO3 has the highest PA content

PAESO/Chicken Feather Composites

Polymer matrix: Phthalated Soybean Oil
Good mechanical properties
High functional groups
Relative low polarity

Fibers: Chicken feather fibers
Reasonable strength
High aspect ratio
Low density
High surface area
Widely available
Cheap

INTRODUCTION

• Dielectrics are basic materials for printed circuit boards (PCB)
• Common dielectrics
  Polymer matrices: polyimide, epoxy, polytetrafluoroethylene
  Reinforcement: e-glass fibers, paper
• More than 70 wt% of PCB is dielectric

OBJECTIVES

• Using greener materials
  Replacing petroleum-based materials by bio-based renewable materials
  Lowering dielectric constants
  Decreasing the delay time of the electronic signals
  Decreasing “cross-talk” effects between metal lines
  Lowering the price

DIELECTRIC PROPERTIES

Right: Dielectric constant and dissipation factor of PAESO polymer (1MHz, room temperature)

Left: Dielectric constant of soy resin and feather fibers (1MHz, room temperature)

The bio-based PAESO/Chicken Feather composite has lower dielectric constants than commercial material FR-4 (~4.2)

PEEL STRENGTH

Top left: Peel strength of soy resin/feather composite
Top right: Peeled copper foil surface
Bottom: Peeled composites surface
The peel strength of the new dielectric laminate is higher than the standard.

FUTURE WORK

Further modification of soy oil resin (introducing less polar functional group)
Heat treatment of carbonization of the fibers
Previous results (FTIR) showed that polarity of fibers decreased after heat treatment.

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