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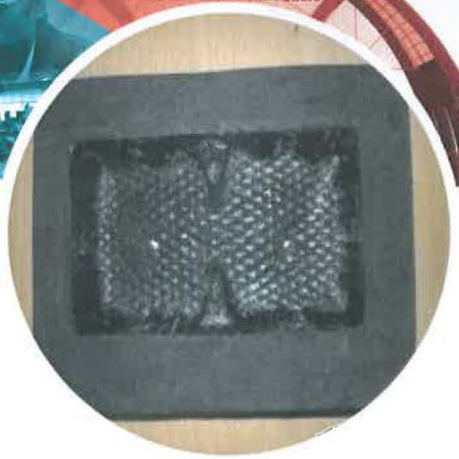
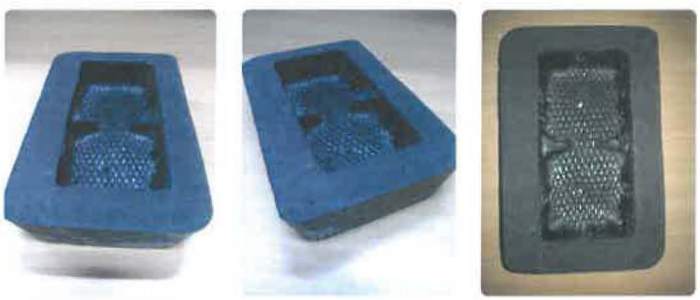
EPOXY-RECYCLED COPPER (E-RECOP) AS THERMOFORMING MOLD MATERIALS



PRODUCT DESCRIPTION

- Rigidity and conductivity of metal thermoforming mold is better but it is expensive in term of fabrication process and material; E-RECOP mold is fabricated using simple, fast fabrication method. Lower material cost and it is able to fabricate in house.
- Recycle copper is chosen due to its properties are almost equivalent to the virgin copper and low in cost. As compared to virgin copper, recycled copper can help in reduce the production cost of the mold material and still provide the equivalent properties as virgin copper.
- Using recycled copper is more environmental friendly compared to a newly mined copper, which the mining and refining process of newly mined copper can cause pollution in the mother earth.



PROCESS FLOW

Raw materials:
- Recycled copper
- epoxy resin
- hardener

The recycled copper filler was added and the mixture was stirred using mechanical stirrer until the mixture was homogeneous.

The mixture was then caste into the mould and the composite was cured using air oven at 100 °C @ 1 hour.

The epoxy- recycled copper mold was obtained.

ADVANTAGES

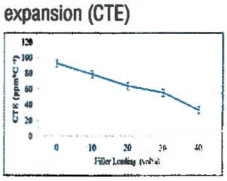
- Low material cost: 77% reduction in cost as compared to copper mold; 20% reduction in cost as compared to aluminium mold.
- Manufacturers are able to fabricate the E-RECOP mold in house- simple fabrication process.
- Lighter weight: 87% reduction in weight as compared to copper mold; 59% reduction in weight as compared to aluminium mold.

NOVELTY

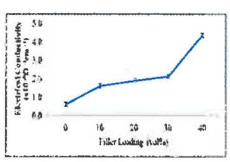
- Recycled waste material to reduce pollution to the mother earth.
- Fast and simple fabrication processing method
- Low fabrication cost
- Lighter weight.

SIGNIFICANT FINDING

Thermal properties
Coefficient thermal expansion (CTE)



Electrical properties
Electrical conductivity



Flexural properties

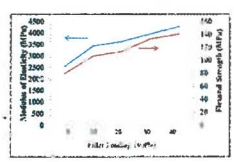


Table 1: Properties of the E-Recop, aluminium and copper molds.

Properties	E-RECOP mold	Aluminium mold	Copper mold
Specify gravity	0.97	2.70	8.94
Flexural strength (MPa)	160	276	172
Flexural modulus (GPa)	4	68	62
Thermal expansion (10^{-6}/ °C)	20	23.6	17

PRODUCT MATERIAL COST

Table 2: Material cost per mold (dimension: 15 cm X 11 cm X 6 cm)

Materials	Cost (RM)	Weight (g)
E-RECOP mold	35.90	1089
Copper mold	192.50	8850
Aluminium mold	54.00	2673

COMMERCIAL PONTENTIAL

- Thermoforming mold materials for small medium thermoforming industries.

ACKNOWLEDGEMENT

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PUBLICATIONS

- Pargi, M.N.F., Chong, Y. T.,Teh, P. L., Hussiensyah, S. &Yeoh, C. K. (2013). The Effect of Particle Size on the Themal and Electrical of Recycled Copper Filled Polyester Composites. International Journal of Materials Engineering Innovation. Pp:291-301
- Pargi, M.N.F., Teh, P. L., Hussiensyah, S. &Yeoh, C. K. (2013). Thermal, Electrical and Physical Properties of Recycled Copper Filled Epoxy Composites. Advanced Materials Research Vol. 620 (2013) pp 208-212.