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INTERNATIONAL CONFERENCE ON MECHANICAL SYSTEM ENGINEERING AND TECHNOLOGY APPLICATIONS

THE MECHANICAL STRENGTH AND FIRE RESISTANCE ANALYSIS OF SEMICONDUCTOR EPOXY MOLD COMPONENT RESIN WASTE REINFORCED RECYCLED HIGH-DENSITY POLYETHYLENE FOR SEMC-RW/R-HDPE COMPOSITE PERMEABLE PAVEMENT

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INTRODUCTION

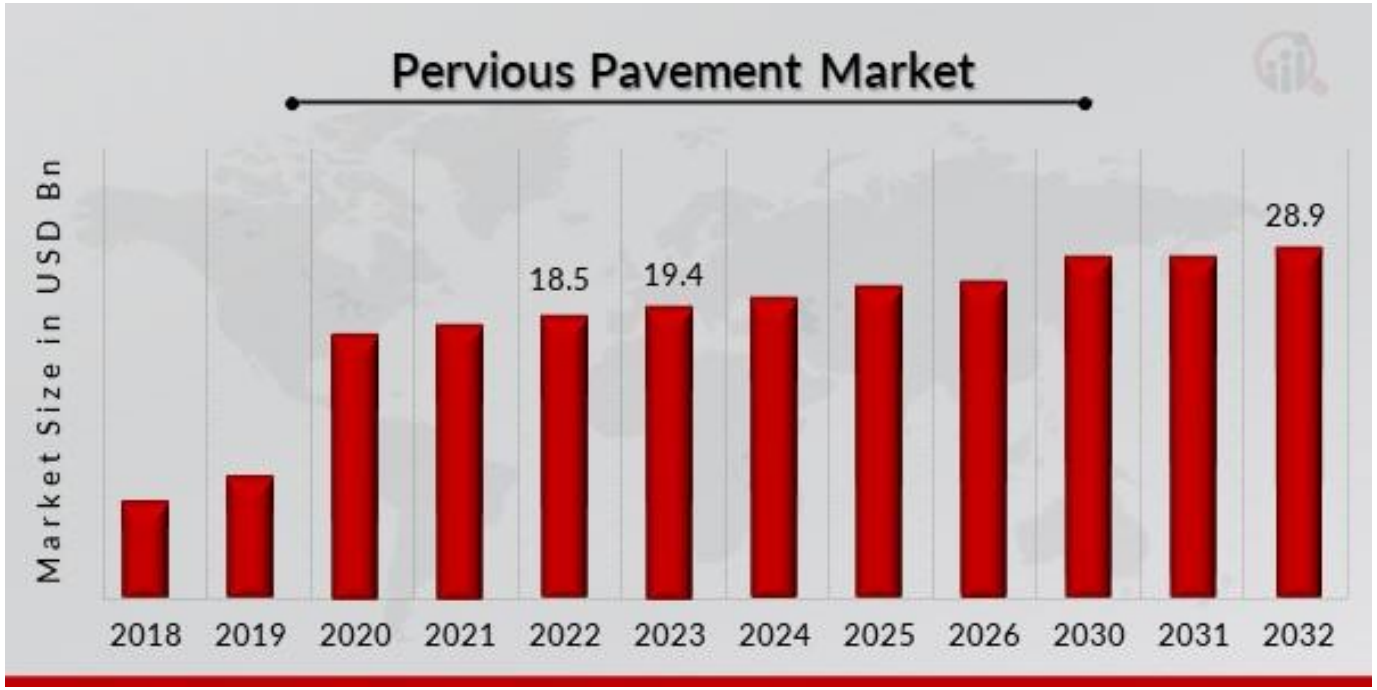
- **POLYMER COMPOSITES** is a lightweight and improved in mechanical properties such as:
  - Tensile strength
  - Bending strength
  - Stiffness
- **PERMEABLE PAVEMENT** enable infiltration of surface water, especially during heavy rainfall.

Asphalt

Concrete Grid

LITERATURE REVIEW

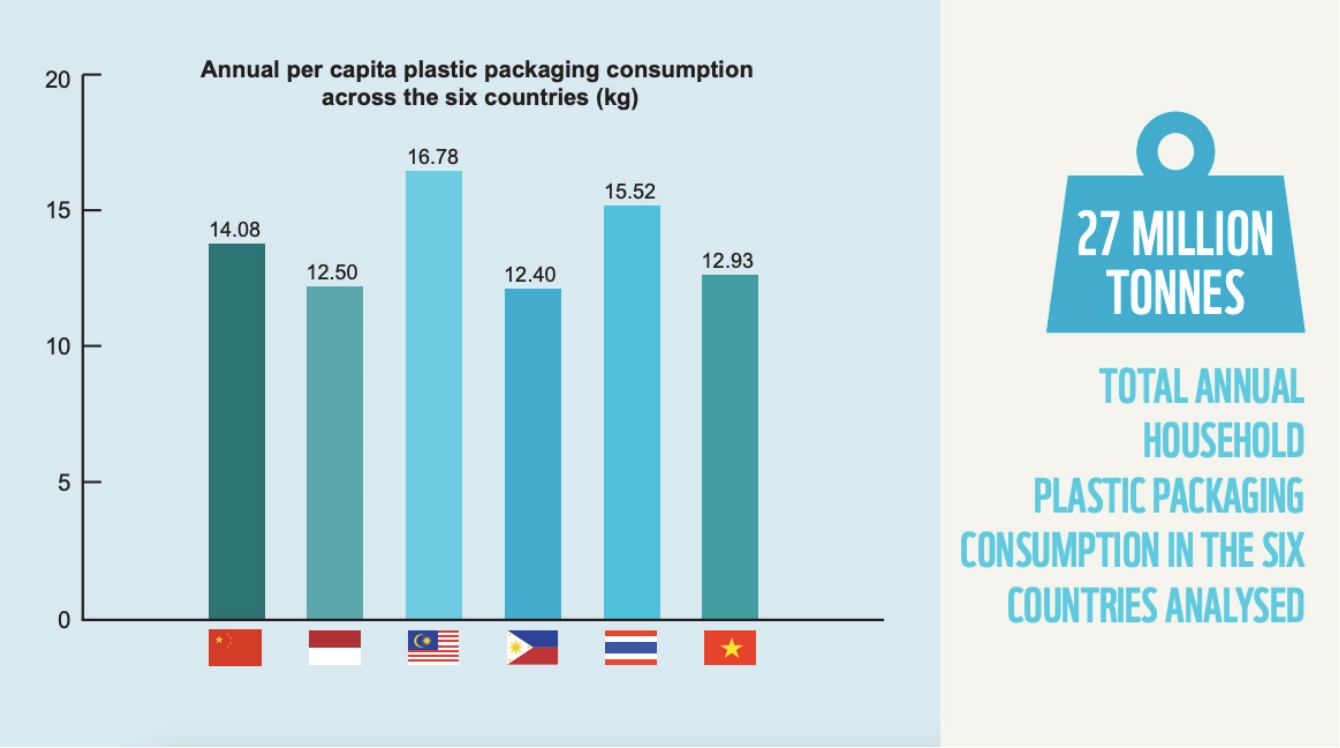
Global Pervious Pavement Market Overview



Source: Secondary Research, Primary Research, MRFR Database, and Analyst Review.

- Market demand for pervious pavement was rising worldwide from 2018 and is projected to grow from USD 19.4435 billion in 2023 to USD 28.94650 billion by 2032.

LITERATURE REVIEW

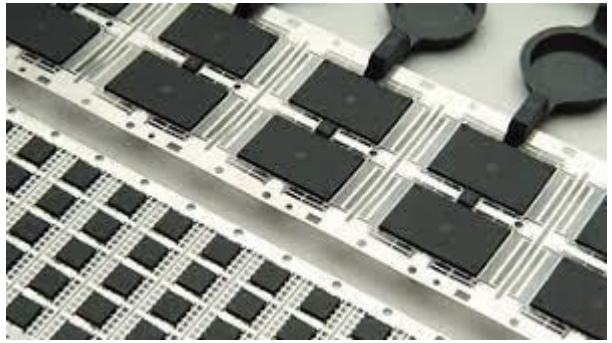


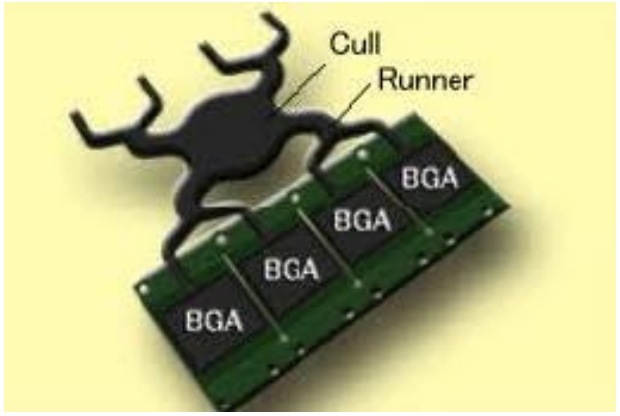
Source: WWF

- Malaysia ranks highest amongst 6 Asian countries on plastic consumption.
- Each Malaysian uses an average of 16.8kg of plastic per year.

LITERATURE REVIEW

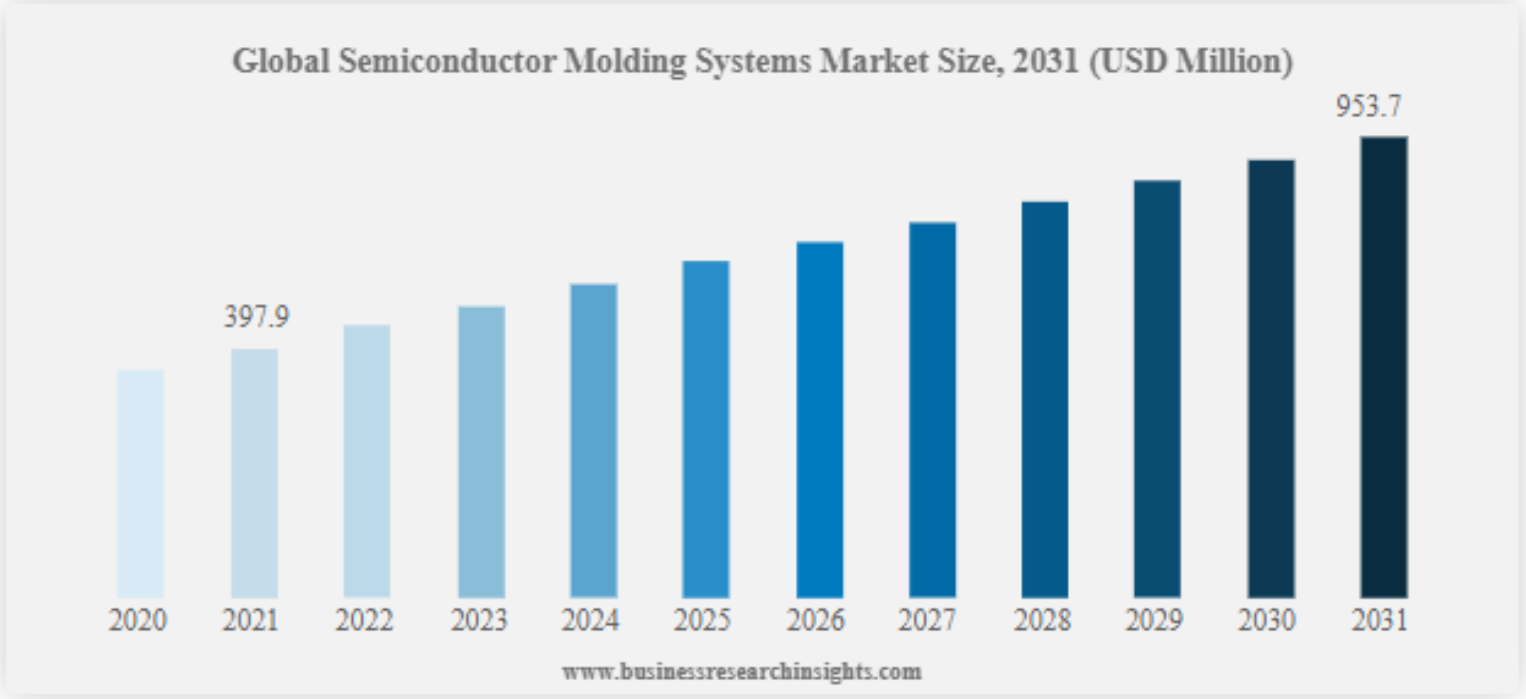
Semiconductor Epoxy Mold Compounds





Resin Waste (SEMC-RW)

LITERATURE REVIEW

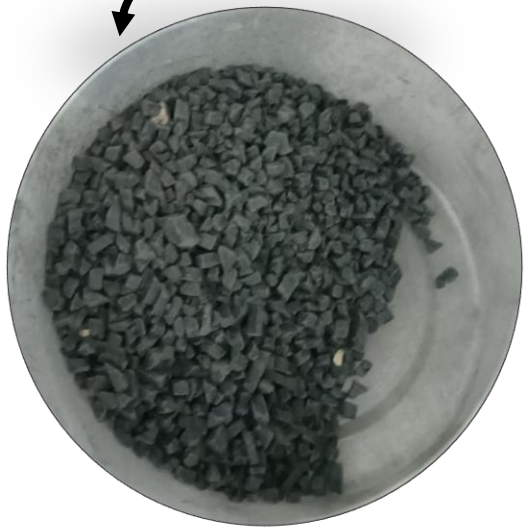


- The **global semiconductor molding system market size** was **USD 397.9 million** in 2021.
- Market is projected to touch USD 953.7 million by 2031.

Source: Business Research Insights, Dec 2023.

LITERATURE REVIEW

SEMC-RW



(R-HDPE)

Permeable Pavement of SEMC-RW and R-HDPE.

LITERATURE REVIEW

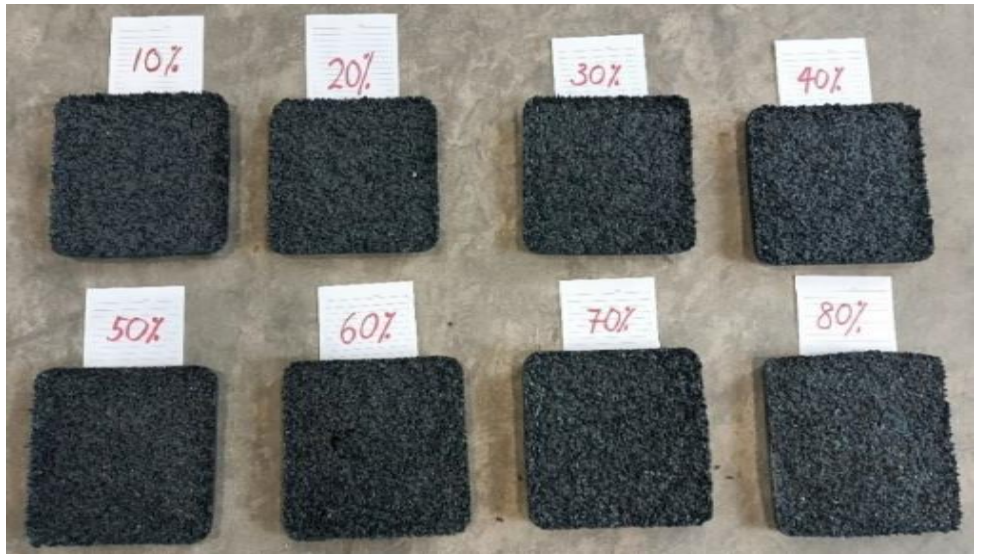
Author (Year)	Type of materials	Result Findings
Zainab Hashim Abbas Al-salami (2019)	Epoxy and fly ash	• There was an increase in strength when epoxy replacement reached above 45%. increase in strength due to (15%) gravel replacement by sand of above 40%.
Mariah Awang (2021)	Palm oil bottom ash and polystyrene	• Achieving an average compressive strength of 4.77 N/mm2 at day 28. • Water absorption and density show no significant correlation with the percentages of expanded polystyrene.
N. Aravind (2021)	Aluminium (Al) powder and Fly Ash (FA)	• Average compressive strength of permeable concrete using admixtures of 15% FA and 1% Al with and without fine aggregate is increased by 13.90% and 1.05% when compared with the corresponding control mixes, respectively. • Permeability flow rate of the permeable concrete with and without fine aggregate is in the range of 7.67–9 ml/s and 14.83–15.83 ml/s, respectively.

METHODOLOGY

- Using different type of composite : SEMC-RW and R-HDPE
- Different composition ratio for sample fabrication

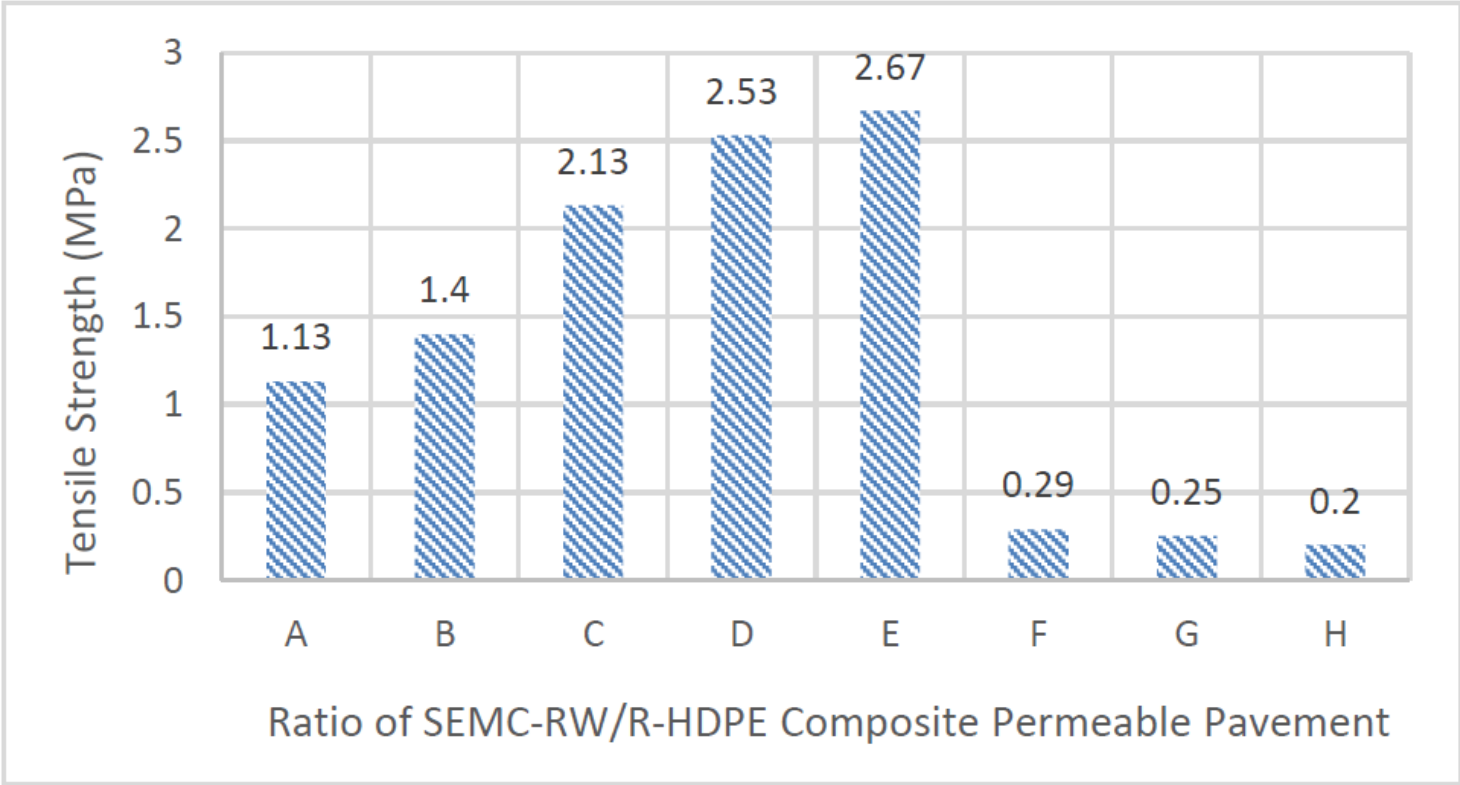
Sample	Ratio of SEMC-RW (wt/wt%)	Ratio of R-HDPE (wt/wt%)	Thickness (mm)
A	10	50	20
B	20	50	20
C	30	50	20
D	40	50	20
E	50	50	20
F	60	50	20
G	70	50	20
H	80	50	20

METHODOLOGY



RESULTS & DISCUSSION

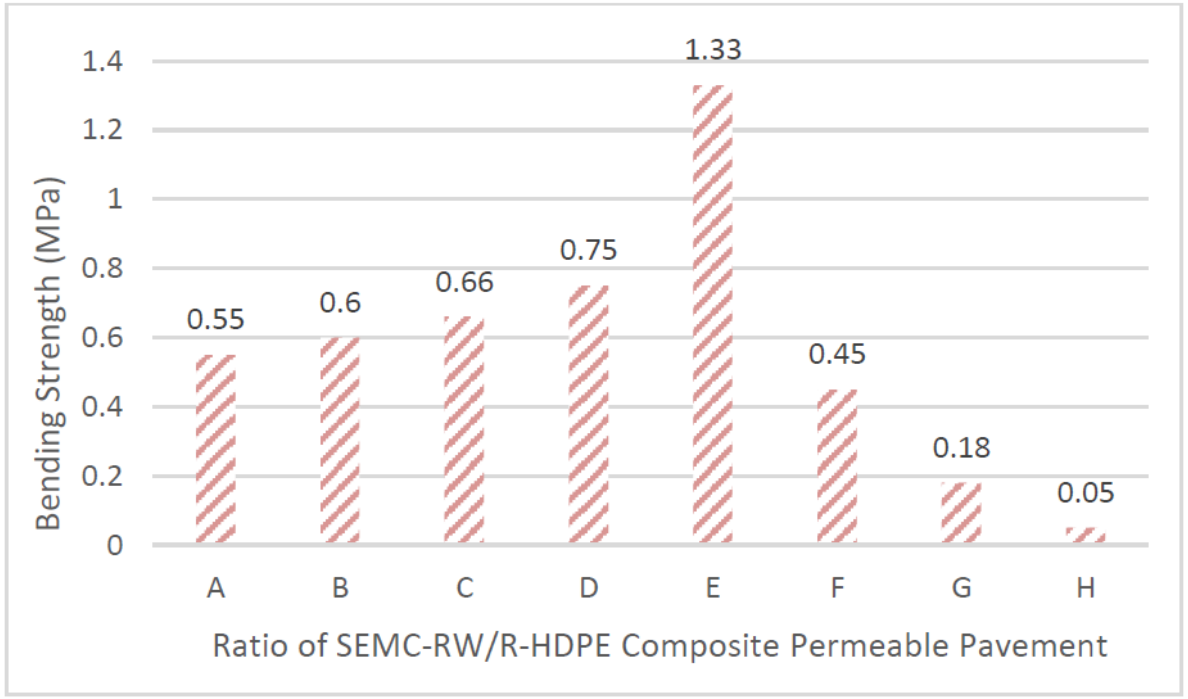
Tensile Strength



Sample E with composition of 50% of SEMC-RW/R-HDPE composite achieved the highest tensile strength at 2.67 MPa and the lowest tensile strength which is sample H (80%) at 0.20 MPa.

RESULTS & DISCUSSION

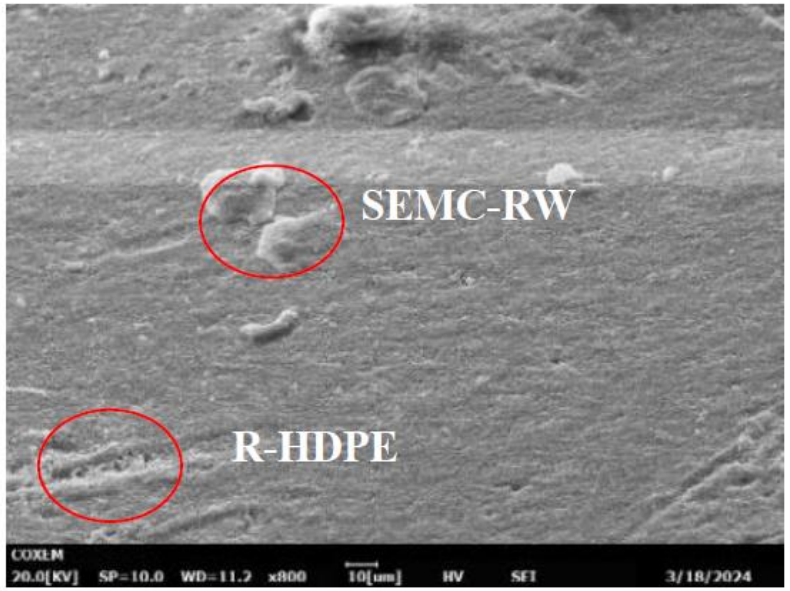
Bending Strength



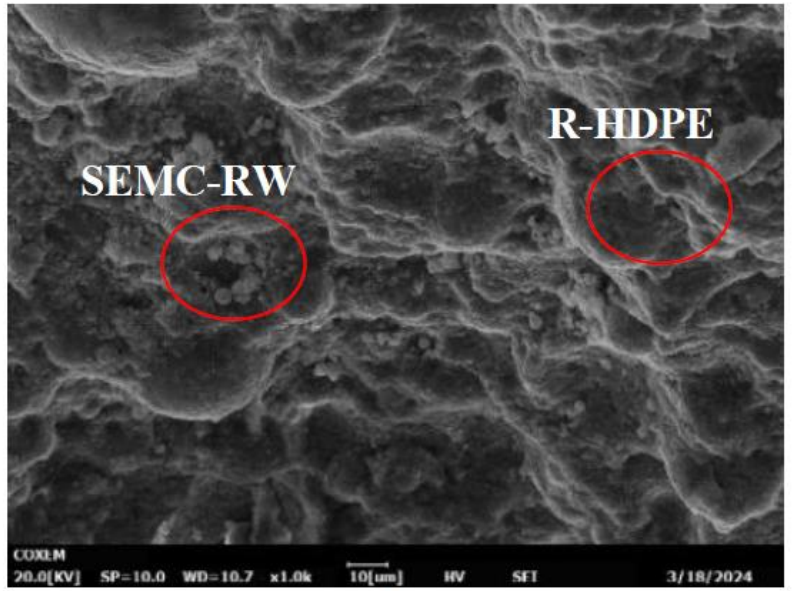
Sample E with composition of 50% of SEMC-RW/R-HDPE composite achieved the highest bending strength at 1.33 MPa and the lowest bending strength which is sample H (80%) at 0.05 MPa.

RESULTS & DISCUSSION

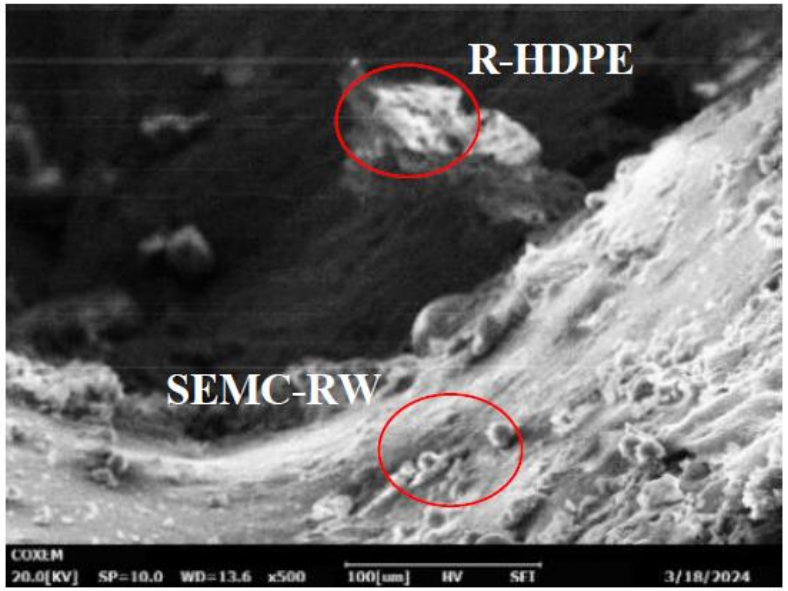
Scanning Electron Microscopy (SEM) Microstructure Analysis



(a)



(b)



(c)

Sample E indicates for 50%, revealed a commendable matrix-reinforcement bonding, showcasing a cohesive structure at magnifications of 500x, 800x, and 1000x. The distribution of SEMC-RW and R-HDPE was more uniform throughout the composite.

RESULTS & DISCUSSION

Fire Resistance Analysis

Sample	Temperature		Rate of Fire Resistance (%)	Max Temperature (>5min)
	External	**Internal**		
A	181.9	48	74	200
B	218.7	51.9	76	215
C	188.7	41.7	77	270
D	184.3	40.2	78	257
E	256.3	41.7	83	440
F	190.2	44.9	76	260
G	157	43.7	72	273
H	169.6	50.7	70	250

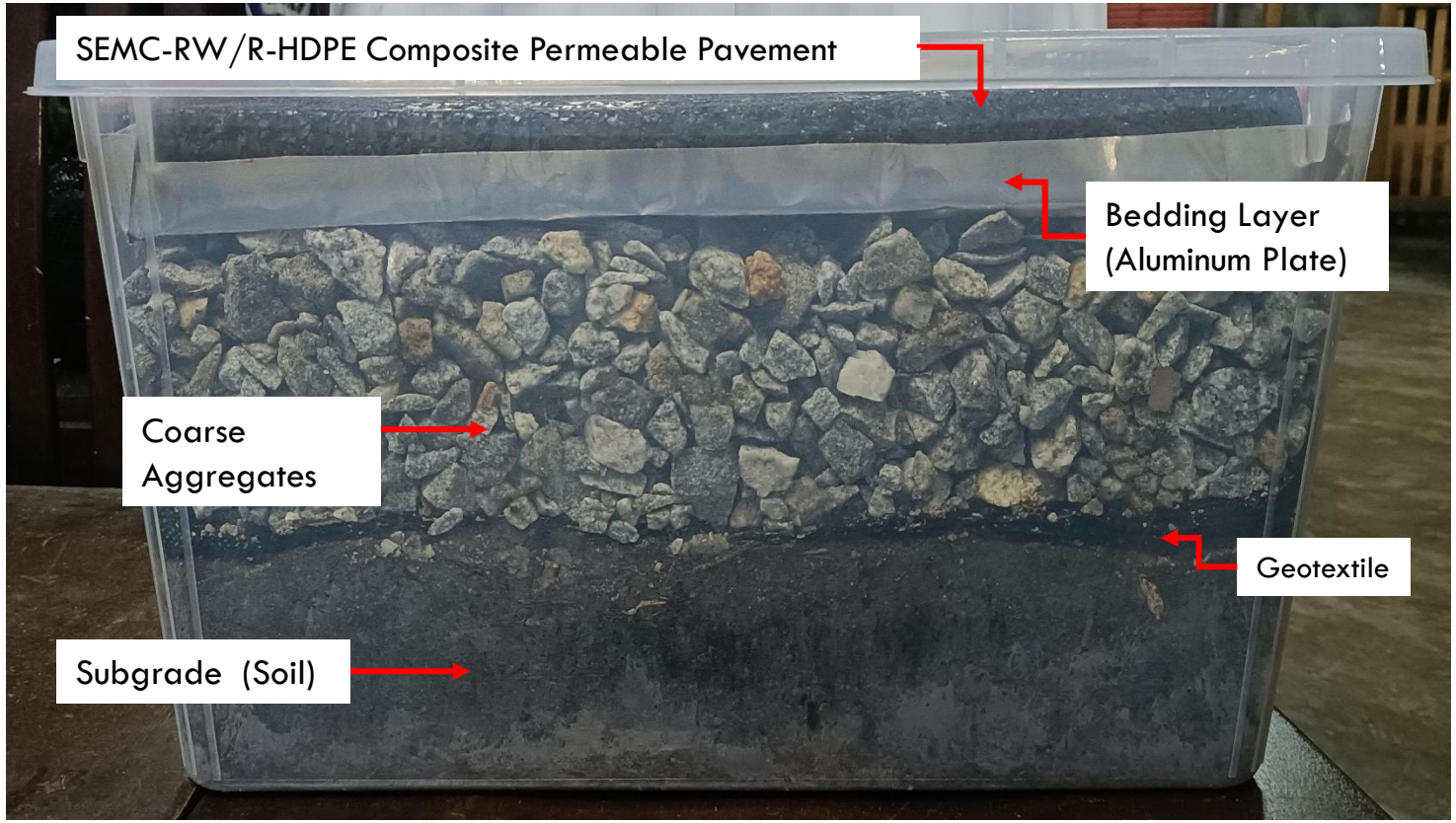
Sample E with composition of 50% of SEMC-RW/R-HDPE composite achieved the highest rate of fire resistance at 83% where it can withstand external temperature of 256.3 °C.

CONCLUSIONS

- **OPTIMUM COMPOSITION** for SEMC-RW/R-HDPE composite is sample E with 50 (wt/wt%)

TESTING	RESULTS
Tensile strength	2.67 MPa
Bending strength	1.33 MPa
Fire resistance analysis	83 %

SEMC-RW/R-HDPE Composite Permeable Pavement System



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THANK YOU