Physical property analysis of polyurethane foam with fly ash as a filler

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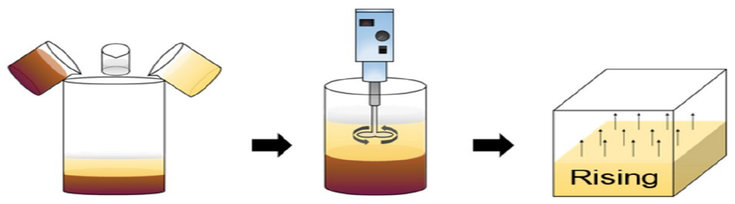
◎ Introduction

- **Polyurethane**(PU) foam is widely used as automotive seats, interior materials, and sound-absorbing materials due to its high sound absorption performance and light weight characteristics.
- Fossil fuels, particularly coal, serve as primary energy sources in power plants, generating combustion by-products including **fly ash** during the process.
- The incorporation of fly ash into polyurethane can enhance physical properties including **Hysteresis loss**, and **SAG factor**, thereby improving comfort while increasing the **Sound Absorption** coefficient for potential acoustic applications.

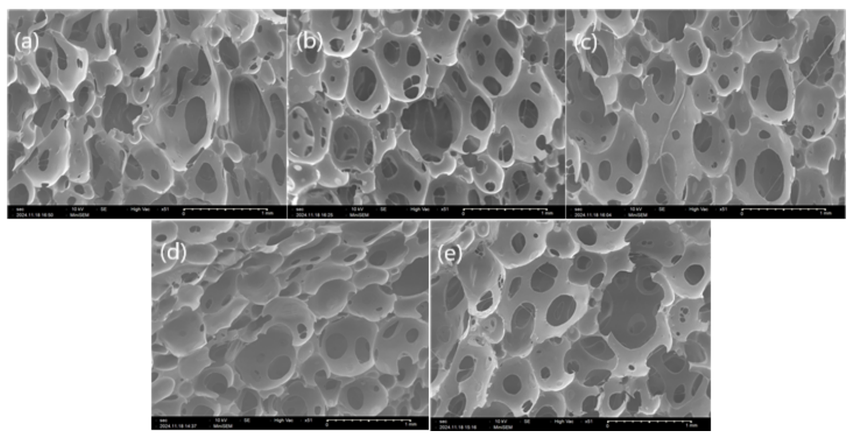
◎ Experimental



1. Mix polyol, catalysts, cross-linker, blowing agent, surfactant and additive then stir in a 1L paper cup at 1,700 rpm for 10 minutes.
2. Add the pre-measured isocyanate to the polyol mixture, then stir the mixture at 6,000 rpm for 8 seconds.
3. Pour the PU mixture into a 200 mm × 200 mm × 50 mm aluminum mold, then cure at 60°C for 20 minutes.
4. Remove the foam from the mold and cut off 10 mm from the foam surface.

◎ Result and Discussion

- SEM images of polyurethane composites with fly ash



(a) 0wt%

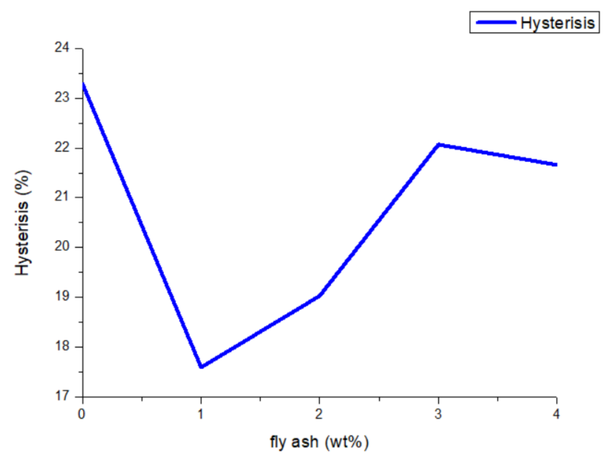
(b) 1wt%

(c) 2wt%

(d) 3wt%

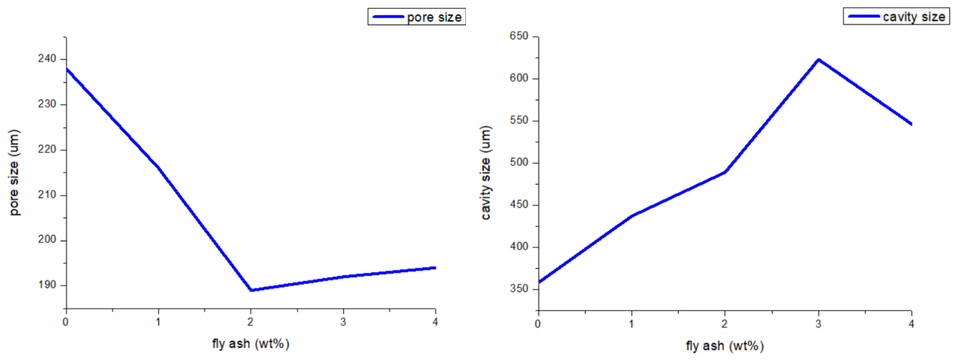
(e) 4wt%

- Relationship between fly ash Addition and Hysteris Loss(%)



	Hys(%)
0wt%	23.29
1wt%	17.59
2wt%	19.03
3wt%	22.07
4wt%	21.66

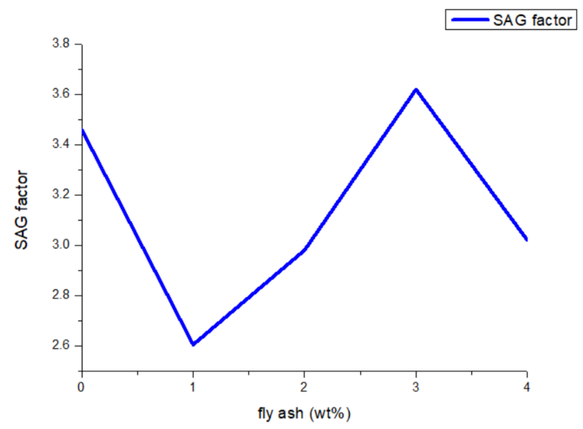
- Relationship between fly ash Addition and Cavity/Pore Sizes



	0wt%	1wt%	2wt%	3wt%	4wt%
Cavity Size	358	437	489	623	546
Pore Size	238	216	189	192	194

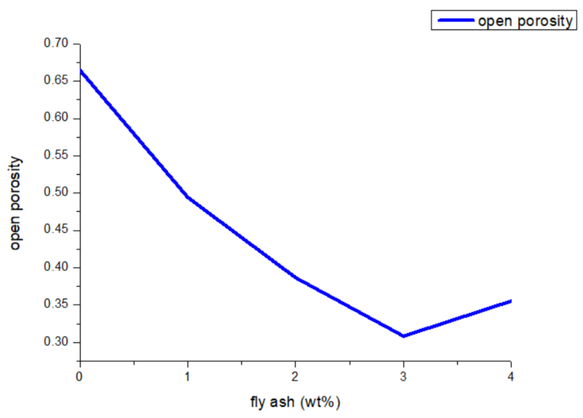
(단위: um)

- Relationship between fly ash Addition and SAG factor



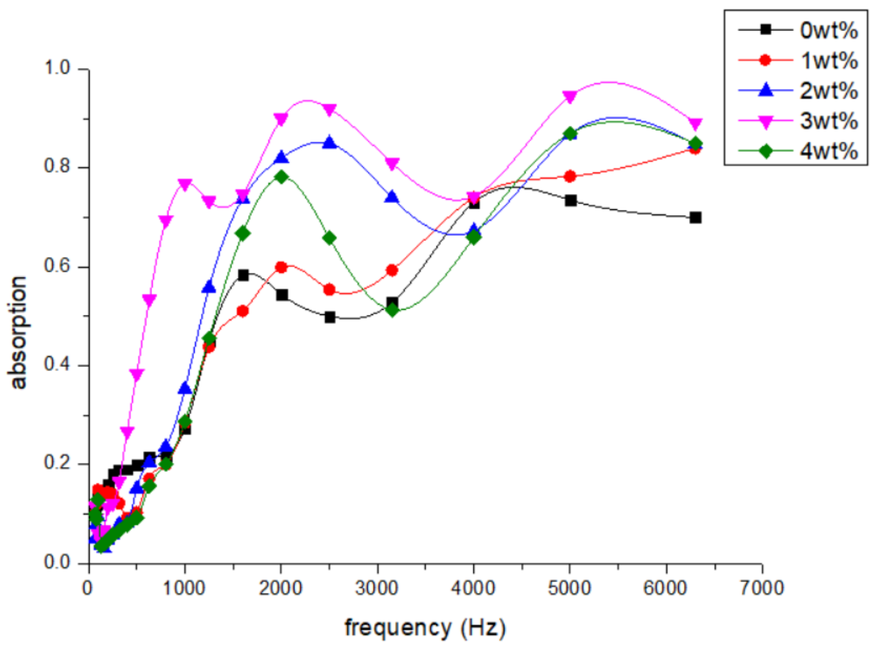
	SAG factor
0wt%	3.46
1wt%	2.60
2wt%	2.98
3wt%	3.62
4wt%	3.02

- Relationship between fly ash Addition and Open Porosity



	Open Porosity
0wt%	0.66
1wt%	0.49
2wt%	0.39
3wt%	0.31
4wt%	0.36

- Relationship between fly ash Addition and Sound Absorption



◎ Conclusion

- Hysteresis loss and SAG factor are crucial parameters that govern the ride comfort perceived by vehicle occupants.
- At 3 wt% polyurethane content, the material exhibits optimal properties with low open porosity, high sound absorption coefficient and SAG factor.
- The enhancement in physical properties can be attributed to the interfacial compatibility between the filler and foam matrix upon filler addition.