Performance Evaluation of Coal Gasification Slag as an Alternative Filler in Asphalt Mortar

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Introduction and Objective

➢ Background
Byproduct during coal gasification process
Coal gasification slag (CGS)
• waste the land resources
• lead to serious environmental problems
Current fillers for asphalt mortar
Limestone powder (LM)
• nonrenewable
• expensive

➢ Objective
Use CGS as an alternative filler of LM in asphalt mortar
Explore the influence of CGS on the rheological properties of asphalt mortar

Sample Preparation and Experimental Method

➢ Raw materials
• Base bitumen (#70)
• CGS
• LM

➢ Preparation of asphalt mortar
Asphalt mortar samples were prepared in the proportions: 50% of base bitumen, 50% of filler
LM was replaced with CGS at 0%, 25%, 50%, 75%, and 100% in mass percentage

➢ Experimental method
• Particle size distribution
• XRD
• SEM
• Softening point test; Penetration test; Viscosity test
• Temperature scanning test; MSCR test

Result and Discussion

➢ Particle size distribution of fillers

• CGS exhibited a wider particle size distribution than LM. The total particle size of CGS was smaller than LM. These characteristics potentially led to improve the cohesion between asphalt binder and CGS.
• The mineral main components of CGS were quartz, calcite, mullite, gypsum, and LM was calcite, implied that asphalt mortar with CGS was more stable than with LM.
• The increment of CGS replacement ratio led to increase in the accumulated strain of asphalt mortar at the same stress level, but presented different affecting level under different stress levels.
• CGS improved the elastic behavior and deformation resistance of asphalt mortar. CGS exhibited a better elastic recovery effect on asphalt mortar under low stress level and improved rutting resistance of asphalt mortar under high stress level. The increment of CGS replacement ratio had negligible effect on the $R_o$ of asphalt mortar, but led to an increase of $J_{o-l}$.

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Findings and Conclusions

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