

What Insulation Material will be the New Darling of the Future Insulated Tank Containers?



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Abstract

The insulated tank containers (medium: chemical liquid, liquid food etc) normally use polyurethane(PU) and mineral wool as the insulation material, which have disadvantages such as environment-unfriendly, short applicable temperature range, and inconvenient installment etc. Researchers are trying to look for better insulation materials as the future substitution, such as nano-insulated paint, nano-aerogel, polyurethane aerogel etc.

Keywords: Insulated tank containers; Polyurethane(PU); Nano thermal insulation material; rock wool; Nano-aerogel; Polyurethane aerogel

Introduction

Every year, about 40,000 new insulated tank containers enter into the chemical logistical market, mineral wool takes 70% of the insulation material, and PU takes the left parts. Table 1 shows the main property of mineral wool and PU [1].

Table1: Present insulation material introduction for the tank container.

Type	Mineral Wool	PU
Temperature range (°C)	-20~350	-20~120
Installment	Blanket, Convenient,	Panel or live foaming inconvenient
Heat conductivity(W/(m•K))	0.044	0.026
Environment affect	Irritant to the skin, dust on the human respiratory system waste disposal,	stimulus Odor , dust on the human respiratory system difficult to recycle the waste
Unit price of insulation material on 20 feet tank container (RMB)	800	2500

Though mineral wool is cheap, but it is not environment-friendly and its high heat conductivity can't supply the requirements of high-end customers. Unit price of PU is about 3 times of that of mineral wool, but PU's heat conductivity is about half of that of mineral wool, whereas, PU's installment is very inconvenient and not environment-friendly [2].

Discussion

For the better insulated property, convenient installment and environment-friendliness, tank manufactures and tank owners are keeping looking for much better insulation material for the future substitution, Some new-type insulation material which is used in aerospace and special fields and even still in research came into our eyesight. Table 2 shows the main property of new insulation materials (such as nano-aerogel, nano insulated paint, polyurethane aerogel) [3].

Nano-aerogel have the lowest heat conductivity, convenient installment, which have being used in the insulation of pipe and vessels though the unit price is about 9 times of that of mineral wool. Nano insulated paint with super convenient installment and wide temperature range is being used in the high-temperature vessels, though its price is about 12 times of mineral wool. Some researchers are researching new complex with PU and aerogel which can have both the advantage of PU and aerogel and higher strength [4].

The same character for Nano-aerogel, nano insulated paint, polyurethane aerogel is nano material, which have been more widely recognized and accepted by tank owners, and we believe that with more research and proper price, these nano insulated materials will be the new darling of the future insulated tank containers [5,6].

Table 2: Future insulation material application on tank containers.

Type	Nano-Aerogel[1-3]	Nano Insulated Paint[4-6]	Polyurethane Aerogel [7]
Temperature range (°C)	-196~600	-20~1000	Commercial products in on progress. Such as BASF. Heat conductivity is estimated about 0.018
Installment	Blanket, Convenient	Paint convenient	
Heat conductivity(W/(m•K))	0.016~0.018	0.026~0.029	
Environment affect	Some or less dust, easy to recycle	Low stimulus Odor, Easy to deal with the waste	
Unit price of insulation material on 20 feet tank container (RMB)	7000	11000	

Conclusion

Nano insulation material (such as nano-aerogel, nano insulated paint, polyurethane aerogel) will be the new darling of the future insulated tank containers. Material Price is one of the key factor for the wide application on the insulated tank containers, researcher are on the way to research insulation material with high property and proper price :

A. To gain better insulated performance , nano-aerogel is for your choice, some researcher are trying to manufacture nano-aerogel at normal pressure and temperature, instead of traditional high temperature and pressure, which will greatly decrease the material cost of nano-aerogel and

improve the wide application of nano-aerogel on insulated tank containers [7].

B. To be more convenient maintenance for the insulation material, nano insulated paint is for your better choice, how to manufacture nano ceramic microspheres with low price is still difficult for the researchers.

C. To gain higher strength of the insulation material, polyurethane aerogel will be OK for you, we hope polyurethane aerogel will rapidly entered into commercial markets.

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