

AV '17 KONFERENCE ASFALTOVÉ VOZOVKY 2017

Evaluation of deicer solution applications on conventional and nano-clay modified asphalts

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Motto: Asfaltové vozovky – bezpečná cesta k prosperitě

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Introduction

In road safety, fighting with snow and ice has an important place.

In cold climatic regions, various techniques are used to combat icing problem.

The use of anti-icing and de-icer is one of the most commonly used methods.

Generally, sodium chloride, potassium acetate, magnesium chloride and sodium acetate are used.

Scope

Various modifiers are used to improve the performance of asphalt pavements.

Nano clay is innovative additive used in asphalt mixtures.

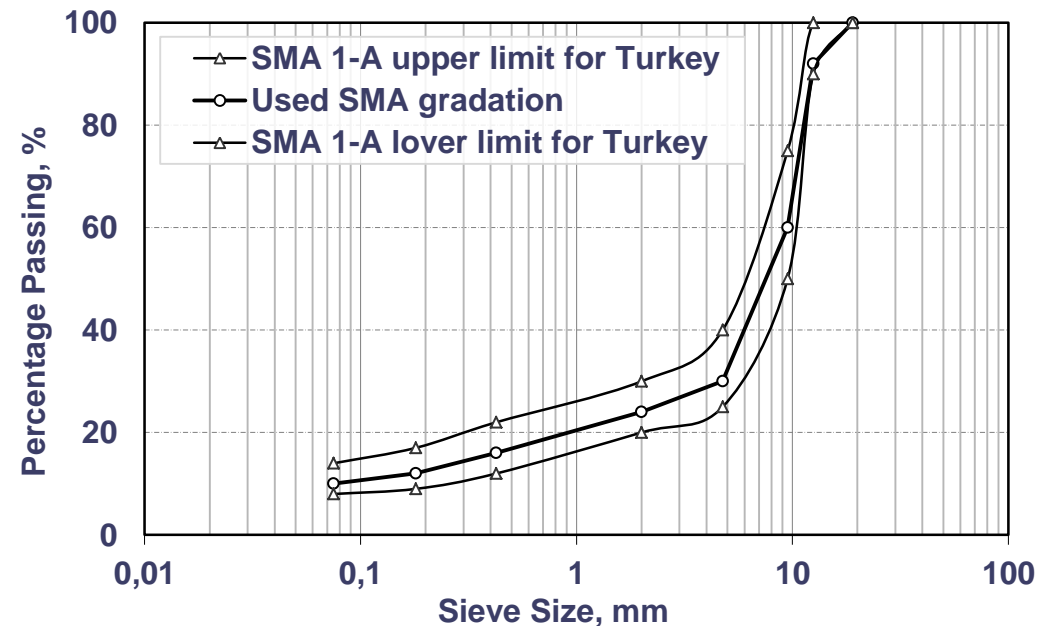
In this study,

- ➔ Effects of de-icers on the asphalt mixture performance,
- ➔ Effect of nanoclay modification on the cracking and stripping behavior of the asphalt mixture was investigated.

Materials and method (1)

Stone mastic asphalt mixture gradation (Turkish specification)

- ➔ 19mm maximum aggregate size
- ➔ Basalt aggregate
- ➔ 50-70 pen. grade bitumen
- ➔ Cellulose fibre



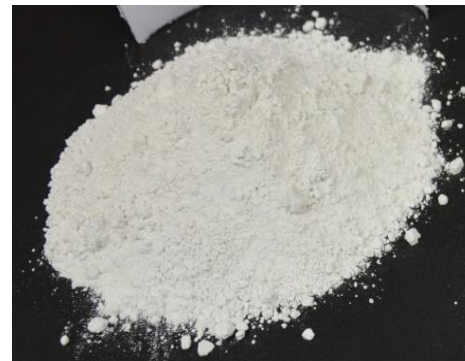
Materials and method (2)

Nanoclay modification was applied

- ➔ Control mixture (unmodified mixture)
- ➔ 2% nanoclay modified mixture
- ➔ 4% nanoclay modified mixture

Nanoclay was added to bitumen according to bitumen weight.

- ➔ High shear mixer
- ➔ 160°C stirring temperature
- ➔ 20 minutes mixing time
- ➔ 4500rpm mixing speed



Materials and methods (3)

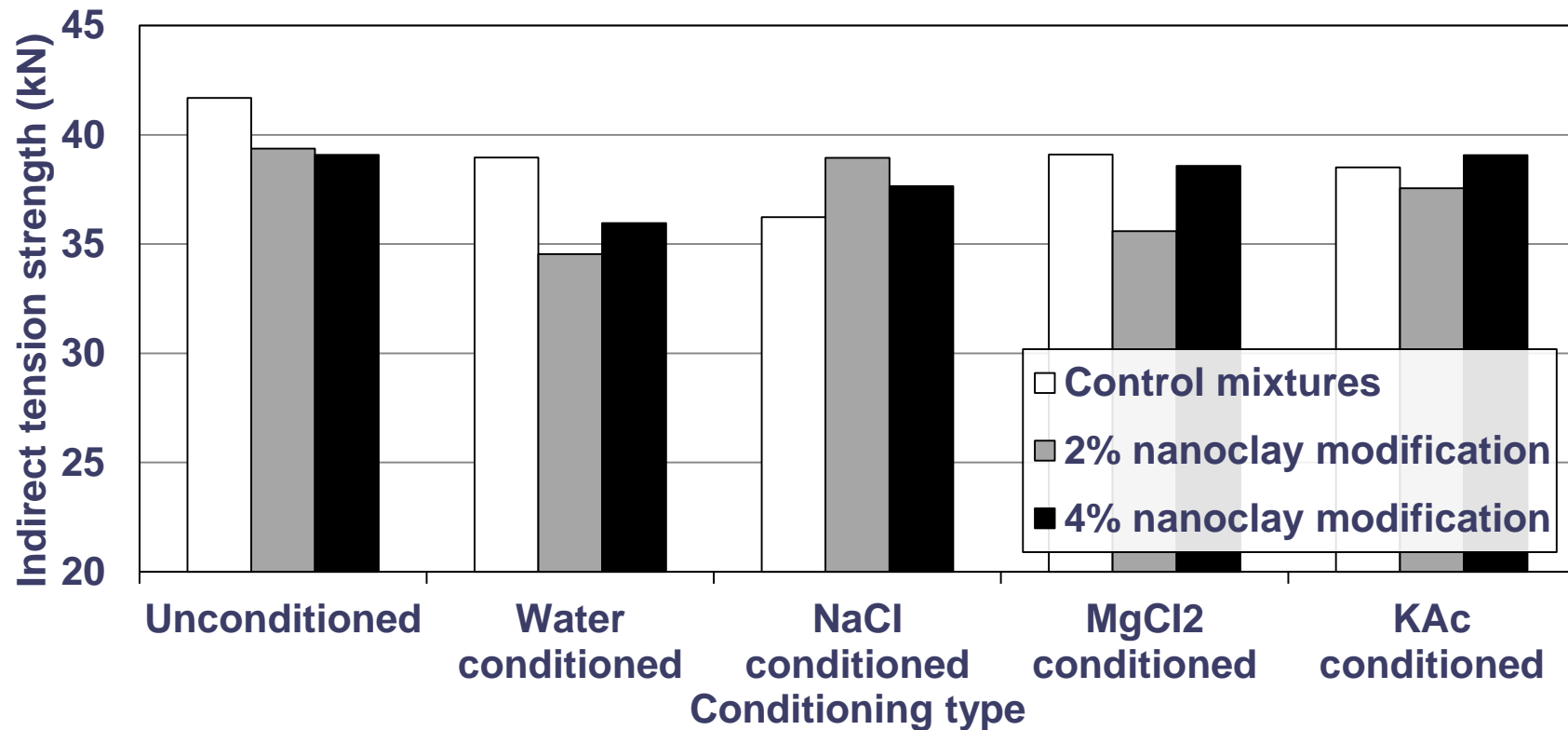
AASHTO T283 conditioning system was applied

The briquettes were divided into 5 groups and different options were used as the conditioning fluid.

- ➔ The first group of samples was **not conditioned**.
- ➔ The second group of samples was conditioned with **pure water**.
- ➔ Third group: **25% sodium chloride** (NaCl) solution
- ➔ Fourth group: **50% magnesium chloride** (MgCl₂) solution
- ➔ The fifth group: **50% potassium acetate** (KAc) solution

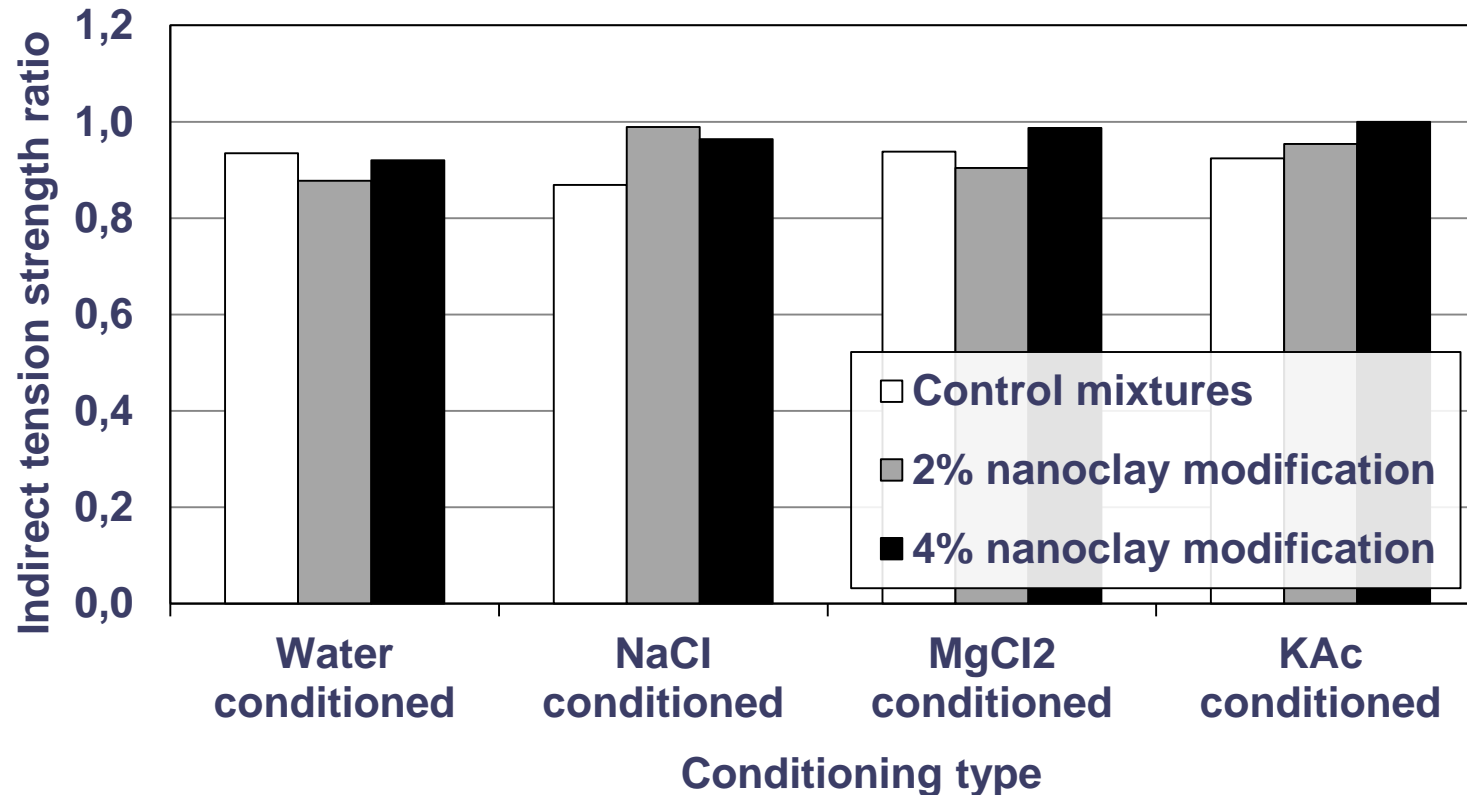
Indirect tensile strength test was performed at 0°C and 25°C test temperatures.

Test results and evaluation



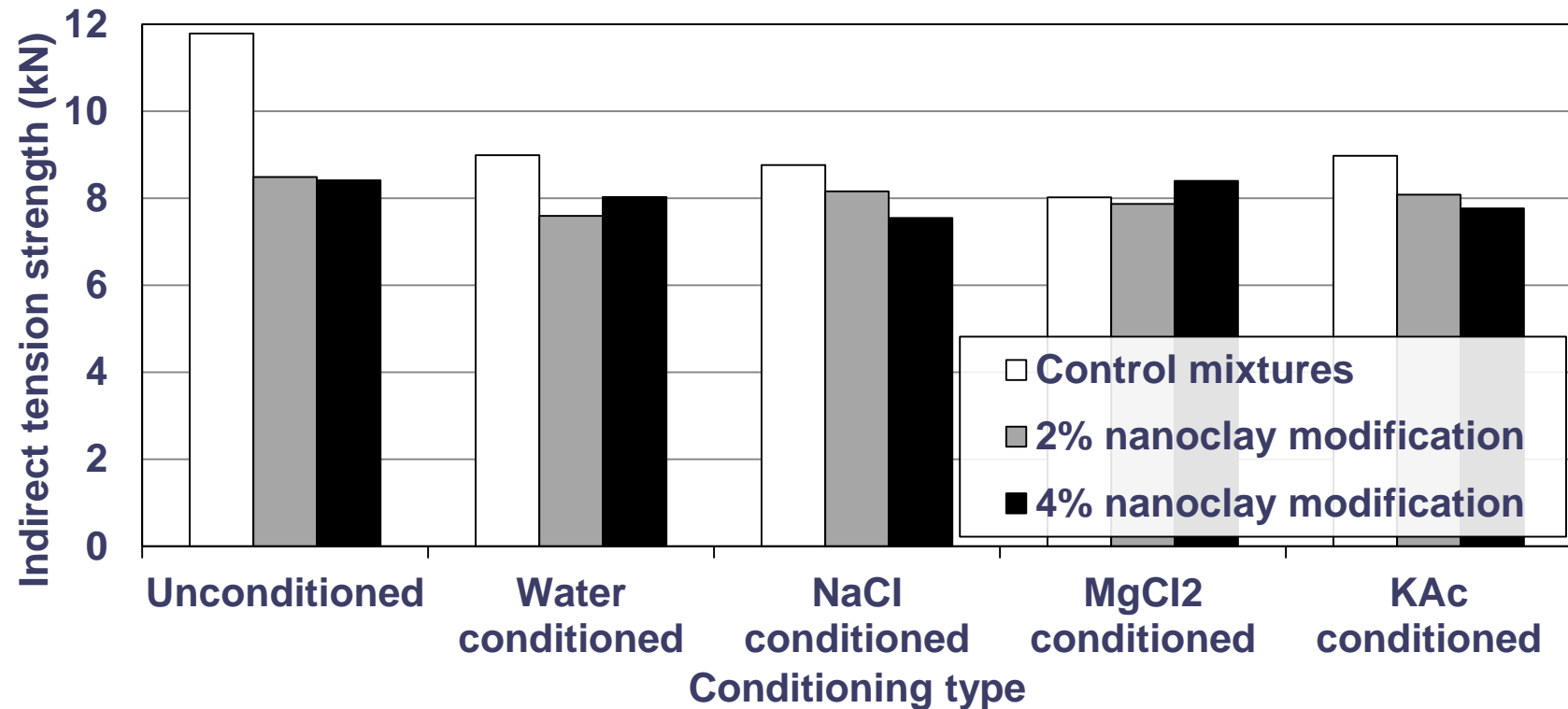
Average indirect tensile strength values at 0°C test temperatures

Test results and evaluation (2)



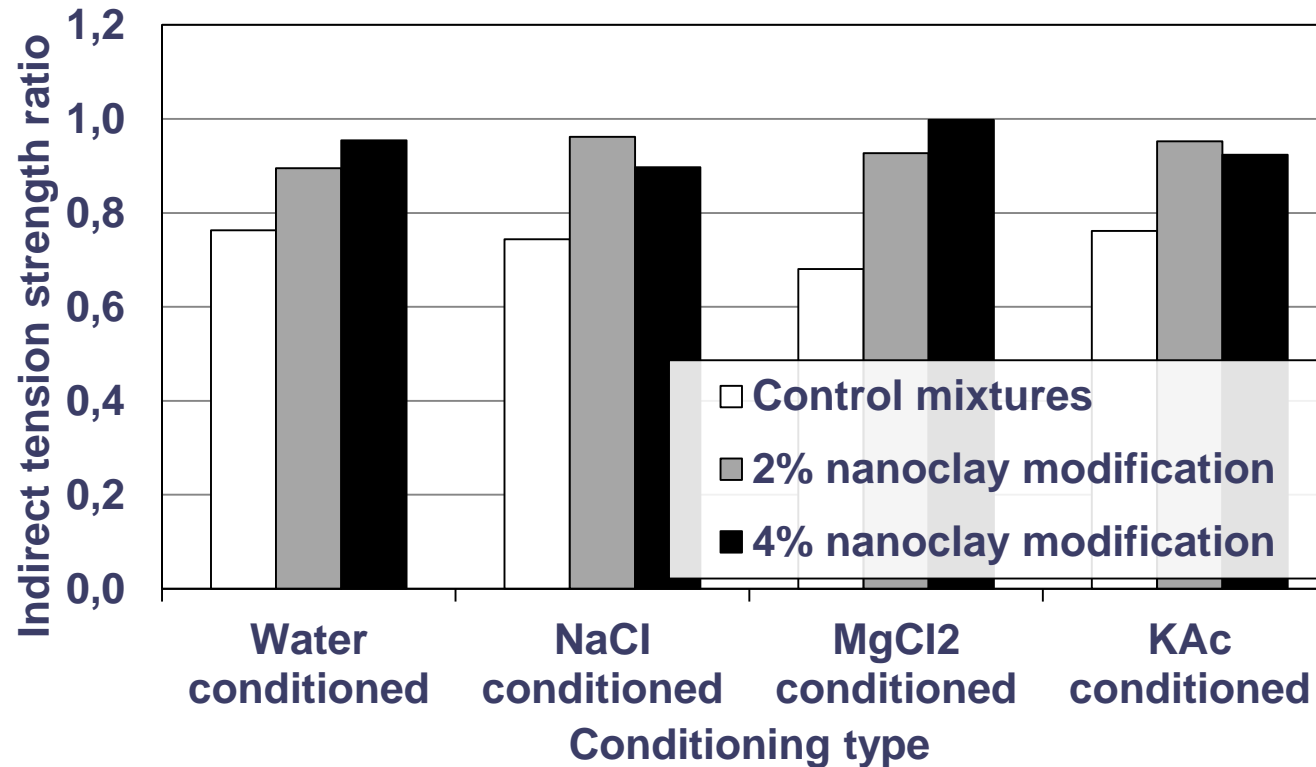
Indirect tension strength ratios at 0°C test temperatures

Test results and evaluation (3)



Average indirect tensile strength values at 25°C test temperatures

Test results and evaluation (4)



Indirect tension strength ratios of mixtures at 25°C test temperatures

Test results and evaluation (5)

Ratio of percentage change in ITSR values

	0°C temperature				25°C temperature			
	Water cond.	NaCl cond.	MgCl ₂ cond.	KAc cond.	Water cond.	NaCl cond.	MgCl ₂ cond.	KAc cond.
Control mixtures	0.0	-7.0	0.3	-1.2	0.0	-2.5	-10.8	-0.2
2% nanoclay modification	-6.1	5.8	-3.3	2.0	17.3	26.0	21.5	24.8
4% nanoclay modification	-1.6	3.1	5.6	7.0	25.1	17.6	30.8	21.0

Conclusions

When the de-icer materials are used in conventional control mixtures moisture damage distress problem increases but a low level of damage increasing is concerned.

Nano-clay modification decreased moisture damage levels. In case of nano clay modification these materials decreases damage levels originated from de-icer solutions.

Damage decreasing levels are thought independently from nano clay ratios.

3% nanoclay modification can be pleaded as a logical ratio.

Thank you for your attention...
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